Technical Manual No.
799855-000D

OPERATION AND MAINTENANCE

INSTRUCTIONS FOR

MODEL 900X MAGNETIC TAPE TRANSPORT

(DUAL-MODE, 125-IPS TAPE SPEED)

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PREFACE

This manual presents information required for the operation and maintenance of the Cipher Model 900X Magnetic Tape Transport (dual mode, 125-ips). Please read it thoroughly before unpacking, installing, or operating the transport. The manual consists of seven sections, as follows:

I	Description and Specifications
II	Unpacking, Inspection, and Installation
III	Operation
IV	Theory of Operation
V	Maintenance
VI	Troubleshooting
VII	Engineering Documentation

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SECTION I

DESCRIPTION AND SPECIFICATIONS

1-1. GENERAL

1-2. The dual-mode, 125-ips Model 900X Magnetic Tape Transport is a high-performance, digital, vacuum-buffered tape transport manufactured by Cipher Data Products, Inc., San Diego, California. It incorporates a dual-gap head, providing read-after-write capability. The transport is designed to operate on 115- to 230-Vac, single-phase, 47- to 63-Hz line power. Reels to 10.5 inches in diameter can be accommodated. Various tape-speed and density capabilities and other options are available, as follows:

a. Overwrite

b. Tape speeds:

(1) Standard: 125, 90, or 75 ips

(2) Nonstandard: Any fixed speed within the range of 25 to 125 ips

c. Data Densities: 800 (NRZI); 1600 bpi (PE)

d. Dual-density combination: 800/1600 bpi (dual-mode NRZI/PE)

e. Local density selection

f. Remote Density selection

g. Facade color (white is standard)

1-3. PURPOSE

1-4. The transport is intended for use in data acquisition and computer processing systems in which data must be acquired and stored on magnetic tape. Writing and reading of digital data are performed in IBM-compatible, NRZI or PE format. Data recorded by a Model 900X transport is completely recoverable by IBM or similar equipment.

1-5. PHYSICAL DESCRIPTION

1-6. The Model 900X transport (Figure 1-1) is designed to be hinge-mounted in a standard, 19-inch equipment rack. All components are mounted on a precision-ground, cast-aluminum plate. When the equipment rack is securely anchored, the printed circuit boards and other internal components can be made accessible from the front by releasing the adjustable pawl fastener and swinging the transport open on its hinges. A transparent, hinged, front cover protects the transport from dust and other foreign matter while allowing observation of tape motion. The pushbutton controls and indicators are mounted on the front trim panel, where they are accessible with the cover closed. The power connector is a standard, three-pin, grounded plug.

1-7. Two printed circuit boards are used in the Model 900X, a read/write board and a control/servo board, mounted on the rear of the mounting plate.

1-8. TAPE DRIVE

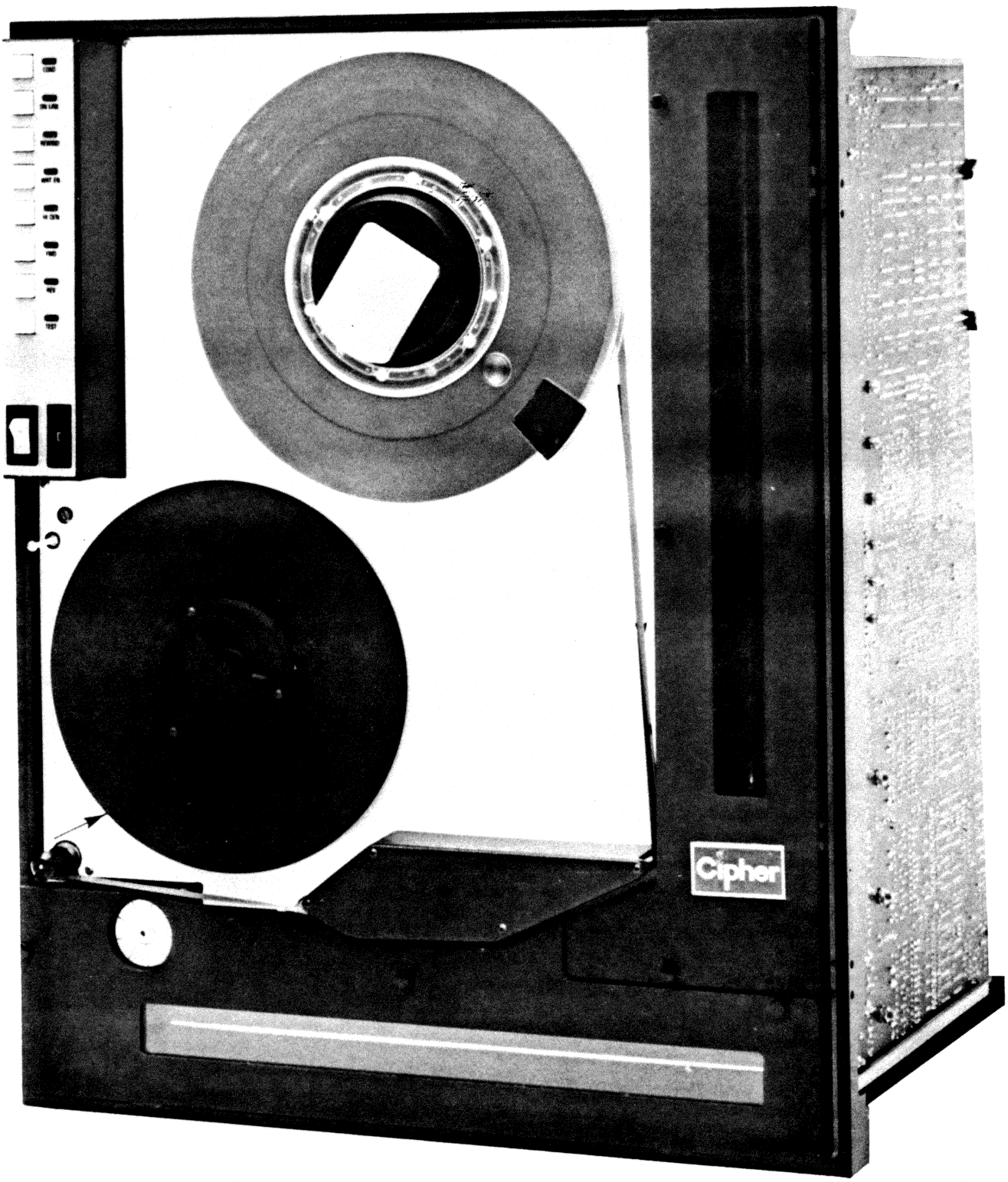
1-9. The reel-to-reel drive mechanism employs two servo-controlled, direct-drive, dc torque motors to drive the tape reels. The file reel is secured to its hub by a lever-actuated expanding ring. Vacuum columns maintain tape tension at 8 ounces (nominal) and serve as tape-storage buffers.

1-10. The tape path includes both roller and fixed guides, the head, and a tape cleaner. The roller guides utilize precision bearings to minimize friction and reduce wear, and the wearing surfaces of the fixed guides and tape cleaner are of sapphire. The fixed guides, on each side of the head, are of the single-edge type. The outer (reference) flange of each guide is fixed to an exact dimension, and the bottom flange is spring loaded to force the tape against the reference edge at all times. This arrangement provides minimum skew and minimizes the effect of tape width variations. In addition, the head is mounted on an adjustable plate which provides for precise azimuth alignment of the read head.

1-11. A sapphire tape cleaner is mounted between the supply vacuum column and the head to minimize tape contamination.

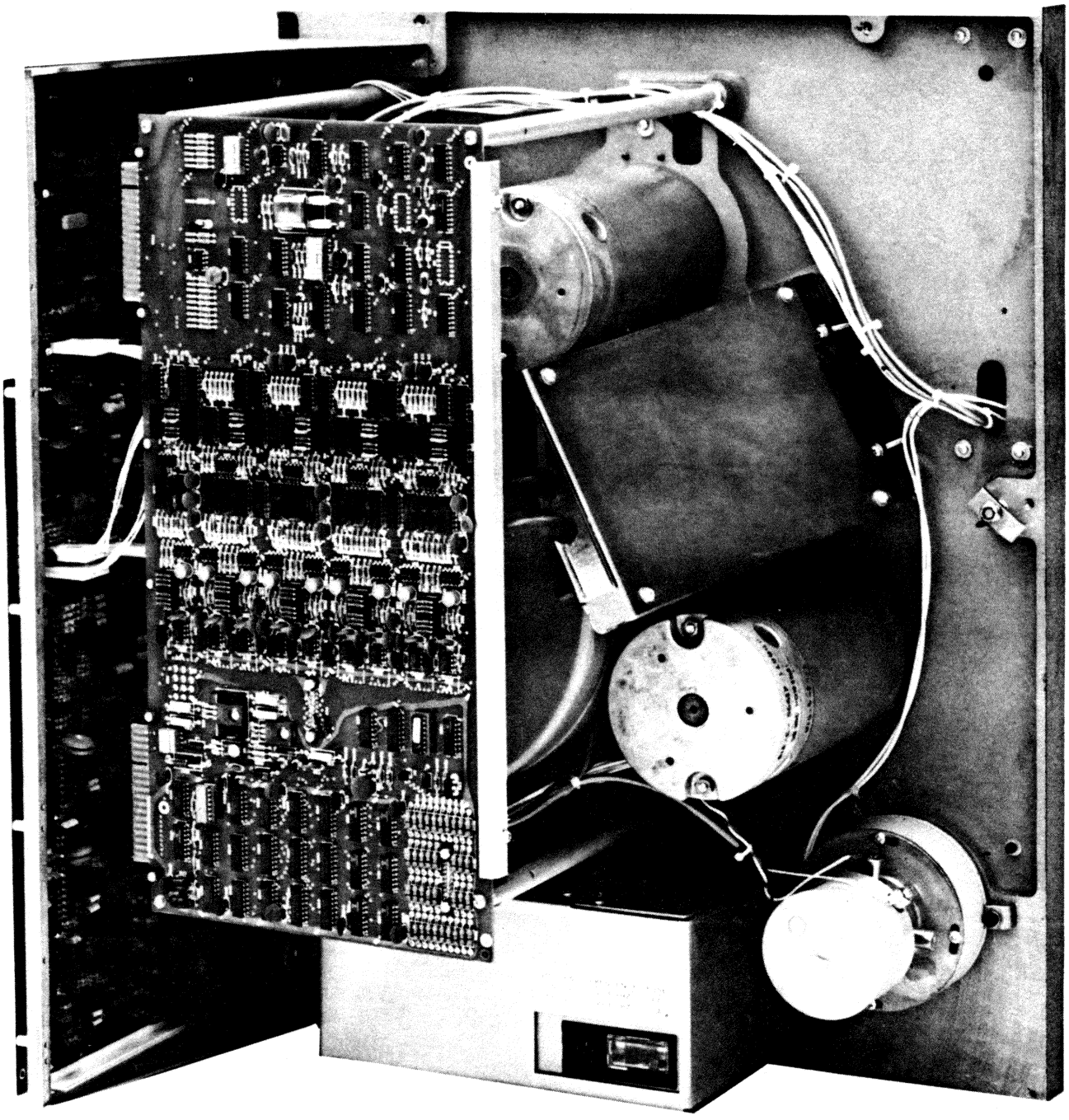
1-12. FUNCTIONAL DESCRIPTION

1-13. Figure 1-2 is a system block diagram. The Model 900X transport uses a 180-degree-wrap capstan drive for controlling tape movement during write, read, and rewind operations. The capstan is controlled by a velocity servo. The velocity information is generated by a dc tachometer that is coupled directly to the capstan motor shaft and produces a voltage proportional to the angular velocity of the capstan. This voltage is compared to the reference voltage from the ramp generator by means of operational amplifier techniques, and



FRONT VIEW

Figure 1-1. Model 900X Transport (Sheet 1)



REAR VIEW

Figure 1-1. Model 900X Transport (Sheet 2)

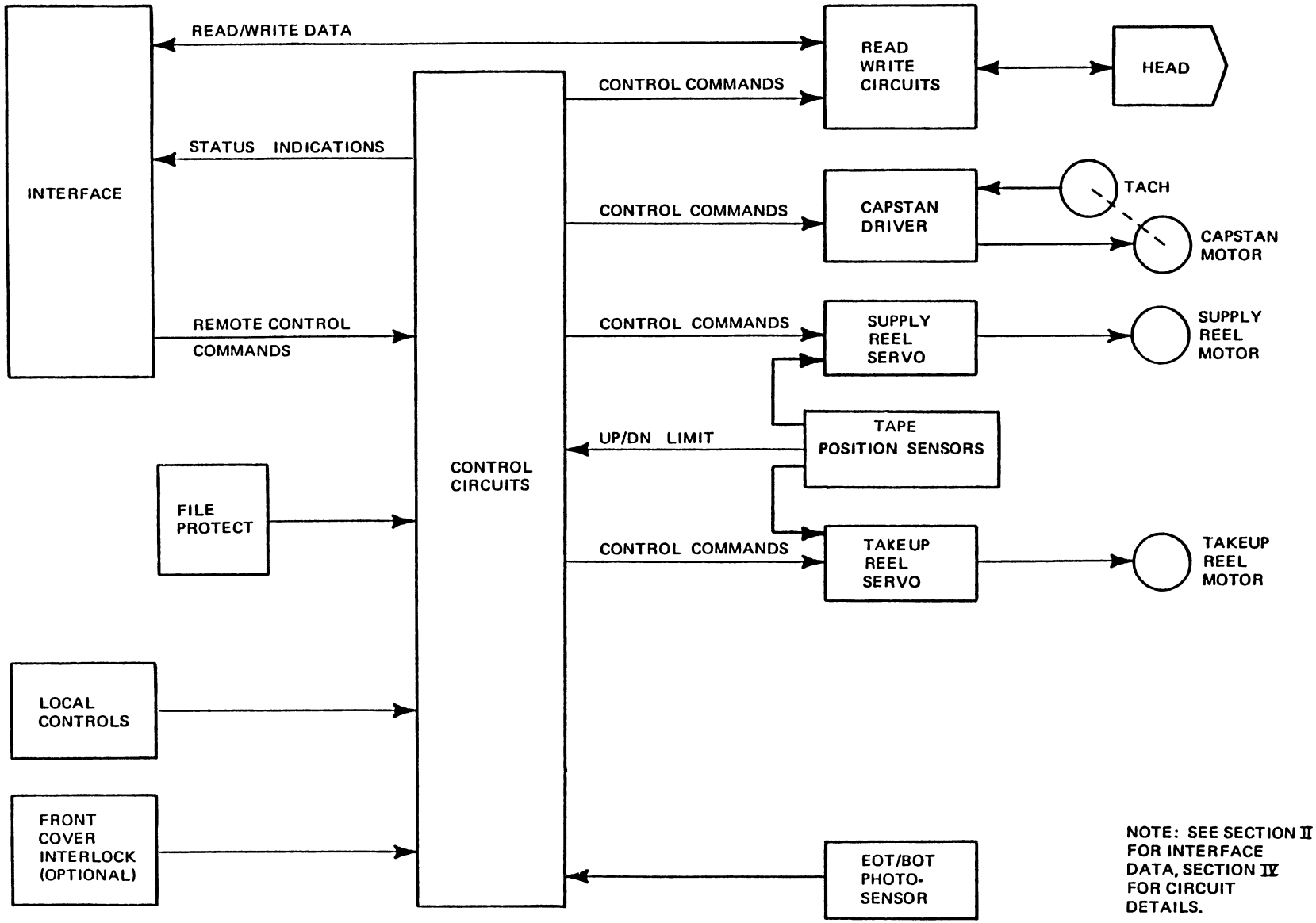


Figure 1-2. System Block Diagram

the difference is used to control the capstan motor. This capstan control technique gives precise control of tape accelerations and tape velocities, thus minimizing tape tension transients.

1-14. During a write operation, the tape is accelerated in a controlled manner to the required velocity. This velocity is maintained constant, and data characters are written on the tape at a constant rate. Thus, the following relationship exists:

$$\text{Bit density} = \frac{\text{Character Rate}}{\text{Tape Velocity}}$$

1-15. When data recording is complete, the tape is decelerated to zero velocity in a controlled manner. Since the write operation relies on a constant tape velocity, inter-record gaps (IRG) must be provided to allow for the tape acceleration and deceleration periods. Control of tape motion to produce a defined IRG is provided externally by the external controller, in conjunction with the tape acceleration and deceleration characteristics defined by the transport specifications.

1-16. An optional overwrite feature provides for editing of previously recorded data. The Overwrite signal causes Write Enable to ramp on and off, minimizing the change in inter-record gap magnetism in rewriting a record. Write Amplifier Reset, used with the overwrite option, causes both write head current and erase head current to be turned off immediately after writing of the new record to prevent destruction of data in the following record.

1-17. During a read operation, the tape is accelerated to the required velocity in a time interval sufficiently short to allow tape velocity to become constant before data signals are received. Nine data channels are presented to the interface. In NRZI operation they are accompanied by a Read Data Strobe (RDS) pulse derived from a monostable multivibrator circuit. The end of a record is detected in the external controller by means of gap-detection circuits, and the tape is commanded to decelerate in a controlled manner. The transport can operate in the read mode in either the forward or reverse direction. When operating in a shuttling mode (e.g., synchronous forward, stop, synchronous reverse, and stop) no turnaround delay is required between the end of one motion command and the beginning of the next motion command in the opposite direction. To guarantee IBM-compatible tapes, with fully saturated gaps and precise dimensions, tape motion must be allowed to cease before switching of the motion control lines and Write Enable line.

1-18. In addition to the capstan control system, the transport incorporates supply and takeup reel servo systems, a vacuum buffer system, a magnetic head and associated read/write electronics, and the control logic.

1-19. The vacuum buffer columns compensate for differences in tape speed arising out of the relatively fast starts and stops of the capstan and those of the slower, high-inertia supply and takeup reels. When the rate of tape travel at the capstan differs from that at which the reels are supplying or taking up the tape, the supply and/or takeup reel tape loops in the vacuum columns decrease or increase in length to compensate for this difference. At the same time, a capacitive sensor measures the resulting displacement of each tape loop and feeds an error signal to the respective reel motor servo. This signal is amplified and is used to control the reel motor, restoring the nominal tape loop operating position in the column. The vacuum buffer system is designed to provide a constant tape tension of 8 ounces, as long as the tape loops are within their operating regions. Tape spillage is prevented, in the event power is lost, by a controlled-halt feature designed into the servo circuitry.

1-20. The magnetic head, under control of the read/write electronics, writes and reads the flux transitions on the tape. The read function is operating continuously, while the write function must be enabled in order to operate. An erase head provides continuous dc erasure across the full width of the tape during write operations.

1-21. The control logic operates on manual commands to enable tape, once loaded, to be brought to the load point. At this stage remote commands control tape motion, writing, and reading. The logic also provides rewind and unload functions, in conjunction with the manual REWIND control. A photoelectric sensor assembly consisting of two LED's and two phototransistors is used to detect the beginning-of-tape (BOT) and end-of-tape (EOT) markers as well as unthreaded or broken tape. The detection area of the sensor assembly is approximately 1.2 inches from the write head gap.

1-22. MECHANICAL AND ELECTRICAL SPECIFICATIONS

1-23. The mechanical and electrical specifications for the transport are shown in Table 1-1.

1-24. INTERFACE SPECIFICATIONS

1-25. Section II contains a table of interface connections. Signal characteristics are as follows:

a. Levels

(1) True is low: 0 to 0.4 volt (approximately).

(2) False is high: +3 volts (approximately).

b. Pulses

(1) Levels as above.

(2) Edge transmission delay over 20 feet of cable is not greater than 200 nanoseconds.

1-26. The interface circuits are so designed that a disconnected wire results in a false signal. Figure 1-3 shows the interface configuration for which the transport is designed.

Net Weight	135 pounds (60.8 Kg)
Shipping Weight	165 pounds (76.5 Kg)
Dimensions:	
Height	24.0 inches (61.0 cm)
Width	19.0 inches (48.3 cm)
Depth (from mounting surface)	13.0 inches (33.1 cm)
Depth (total)	16.2 inches (41.2 cm)
Mounting (standard 19-in. RETMA rack)	EIA specifications
Power	115 or 230 Vac, 47 to 63 Hz, 330 watts nom.
Acoustic Noise	65 dBA, max., 1 meter, without cabinet
Fuse	6.0/3.0-ampere, 3AG, 115/230-Vac
Tape (computer grade):	
Width	0.5 inch (1.27 cm)
Thickness	1.5 mil (3.81 mm)
Reel Diameter	10.5 inches (26.67 cm), max.
Tape Tension	8 ounces (226.8 grams) (nominal)

Table 1-1. Mechanical and Electrical Specifications

Recording Mode & Density:	
Nine-track: IBM-compatible NRZI	800 bpi
Nine-track: IBM-compatible PE	1600 bpi
Nine track: Dual-mode NRZI/PE	800/1600 bpi
Tape Speed: Standard	125/90/75 ips
Nonstandard Available	25 to 125 ips
Speed Variation:	
Instantaneous	±3% (max., byte-to-byte)
Long term	±1% (max.)
Rewind Speed	300 ips (nom.)
Start/Stop Time (inversely proportional to tape speed)	3.0 ms (nom.) at 125 ips
Start/Stop Distance	0.19(±0.02) inch (0.48(±0.05) cm)
Interchannel Displacement Error	150 microinches (0.004 mm) max.
Beginning of Tape (BOT) and End of Tape (EOT) detectors	Solid-state, modulated photoelectric (IBM-compatible)
Interface	Industry-compatible TTL (Low True)
Electronics	Silicon-TTL including low power, MOS microprocessor
Operating Temperature	2° to 50°C
Relative Humidity	15 to 95%, noncondensing
Altitude	0 - 8200 feet (0 - 2500 meters)

Table 1-1. Mechanical and Electrical Specifications (Continued)

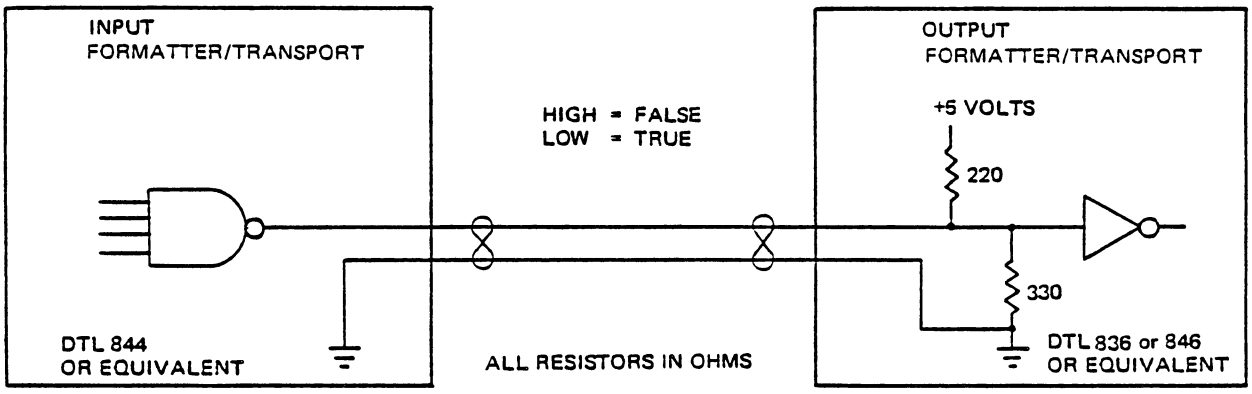


Figure 1-3. Interface Configuration

SECTION II

UNPACKING, INSPECTION, AND INSTALLATION

2-1. GENERAL

2-2. This section presents instructions for unpacking, inspecting, and installing the transport.

2-3. UNPACKING AND INSPECTION

2-4. The transport is shipped in a double container to minimize the possibility of damage during shipping. Unpack as follows:

a. With shipping container on floor or workbench, cut side and center tapes securing top of outer box.

b. Pull box-top flaps down along sides of box, and turn entire package over on open side of outer box. Lift off outer box and remove packing blocks.

CAUTION

Do not cut center tape of inner box without first cutting side tapes and pulling flaps away from top of container. Plastic door of transport can be damaged by failure to observe this precaution.

c. Cut side tapes securing top of inner box, pull flaps up as far as possible, and cut center tape. Open box, fold flaps back, turn over on open side, and lift off box.

d. Check contents of shipping container against packing slip, and inspect for possible damage. <u>If damage exists, notify carrier</u>.

e. Examine vacuum columns, reel hub, capstan, and other components in tape path for foreign matter.

f. Check printed circuit boards and all connectors for correct installation.

2-5. POWER CONNECTION

2-6. A removable power cord is supplied for plugging into a polarized 115-volt outlet. For other power sockets, the supplied plug must be removed and the correct plug installed.

2-7. OPERATING VOLTAGE SELECTION. The Model 900X can be operated over a wide range of line voltages with no changing of transformer taps. Four ranges are available: 90 to 110 Vac, 110 to 135 Vac, 190 to 230 Vac, and 230 to 270 Vac. Both a voltage selector PWB and the fuse are located in the power cord connector housing mounted in the power supply chassis. One side of the voltage selector PWB has the numbers 120 and 240, each printed upside down from the other, on one side of the PWB and numbers 100 and 220 similarly printed on the other side. When line voltage is 90 to 110 volts, the PWB should be plugged in so that number 100 is facing upward and right-side-up to the installer. For 190 to 230 volts, the number should be 220; 110 to 135 volts, number 120; and 230 to 270 volts, number 240. For the 90-to-135-volt ranges, the fuse should be of a 6-ampere rating; for the 190-to-270-volt ranges, a 3-ampere rating.

CAUTION

To prevent damage to the transport and ensure proper operation, be sure the voltage selector PWB and fuse are proper for the power source to be used before applying power to the transport.

2-8. INITIAL CHECKOUT

2-9. Section III contains a detailed description of all controls. To check for proper transport operation before placing in the system, proceed as follows:

a. Connect power cord.

b. Clean tape path as directed under paragraph 5-3.

c. Load tape in accordance with instructions in paragraph 3-5.

d. Turn power on by switching POWER switch.

e. Momentarily depress LOAD control to apply capstan-motor and reel-motor power.

f. Momentarily depress LOAD control to initiate load sequence. Tape will move forward until it reaches BOT tab. LOAD indicator should illuminate when BOT tab reaches photosensor and remain illuminated until tape moves off load point. At this point there will be no action when LOAD control is depressed.

g. Check ON LINE pushbutton by depressing repeatedly and observing that ON LINE indicator is alternately illuminated and extinguished.

h. With transport off line (ON LINE indicator not illuminated), press FWD control. Run several feet of tape onto takeup reel, and press FWD control again to stop tape.

i. Check components of tape path visually for correct tape tracking (tape riding smoothly in head, guides, etc.).

j. Press REV switch. Tape will move backward until BOT tab reaches photosensor, when it will stop.

k. Check tape tracking as in step i.

l. Using FWD control, run several feet of tape onto takeup reel. Depress FWD control again to stop tape. Depress REWIND control momentarily to initiate rewind mode and light REWIND indicator. Tape will rewind to BOT tab and stop with BOT tab at load point. If REWIND control is momentarily depressed when tape is at BOT, REWIND indicator will be illuminated, and tape will be unloaded from vacuum columns and rewound at low speed. This procedure is used to unload tape (paragraph 3-7). Reel can then be removed.

m. Make final check of tape tracking, as in step i.

2-10. RACK MOUNTING

2-11. The transport is designed to be mounted in a standard, 19-inch-wide, RETMA equipment rack. A front panel height of 24 inches and a minimum depth of 12.5 inches behind the mounting surface are required. Note outline dimensions in Figure 2-1, and mount the transport as follows:

a. Install hinge pin blocks on equipment rack using three 10-32 pan-head screws per hinge. Do not fully tighten screws. Place No. 10 shim washer on each pin.

b. Set shipping frame down with front door of transport facing up (i.e., lying in horizontal position). Remove screws securing transport to frame.

c. Lift transport out of shipping frame, position 60 degrees from closed position, and hang on hinge pin blocks.

d. Adjust hinge blocks on equipment rack so that transport hangs symmetrically in rack. Tighten screws.

e. Close tape transport into rack and install safety block, using 4-40 screw.

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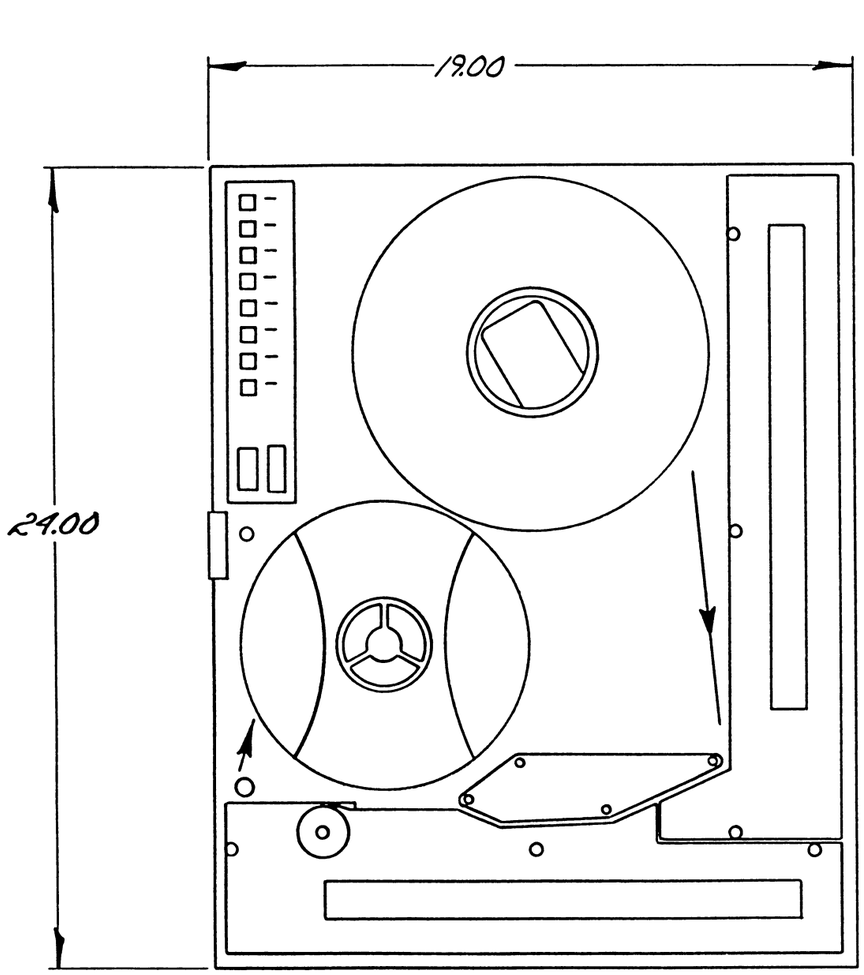
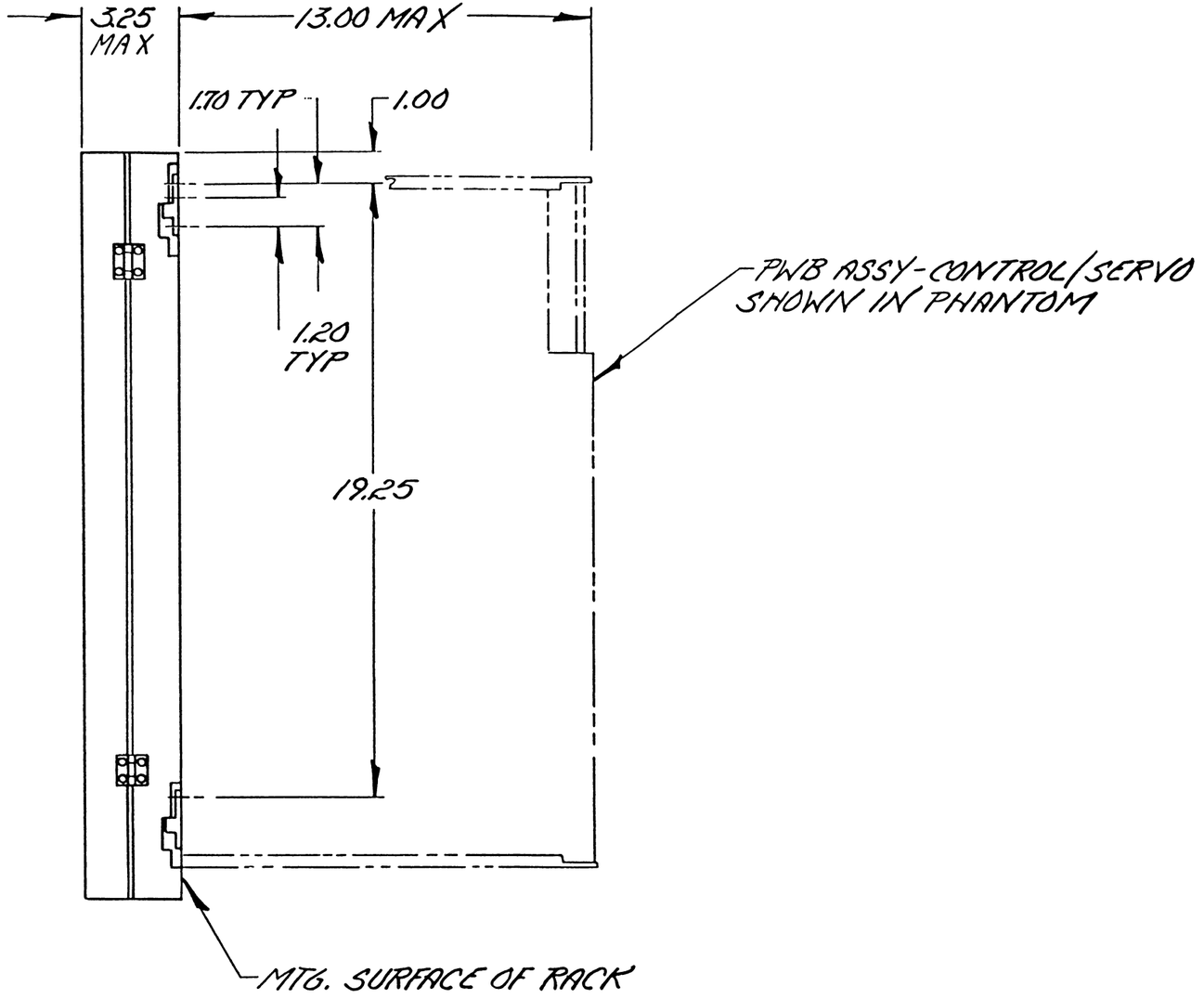


FRONT VIEW



SIDE VIEW

Figure 2-1. Model 900X Outline Dimensions (Sheet 1)

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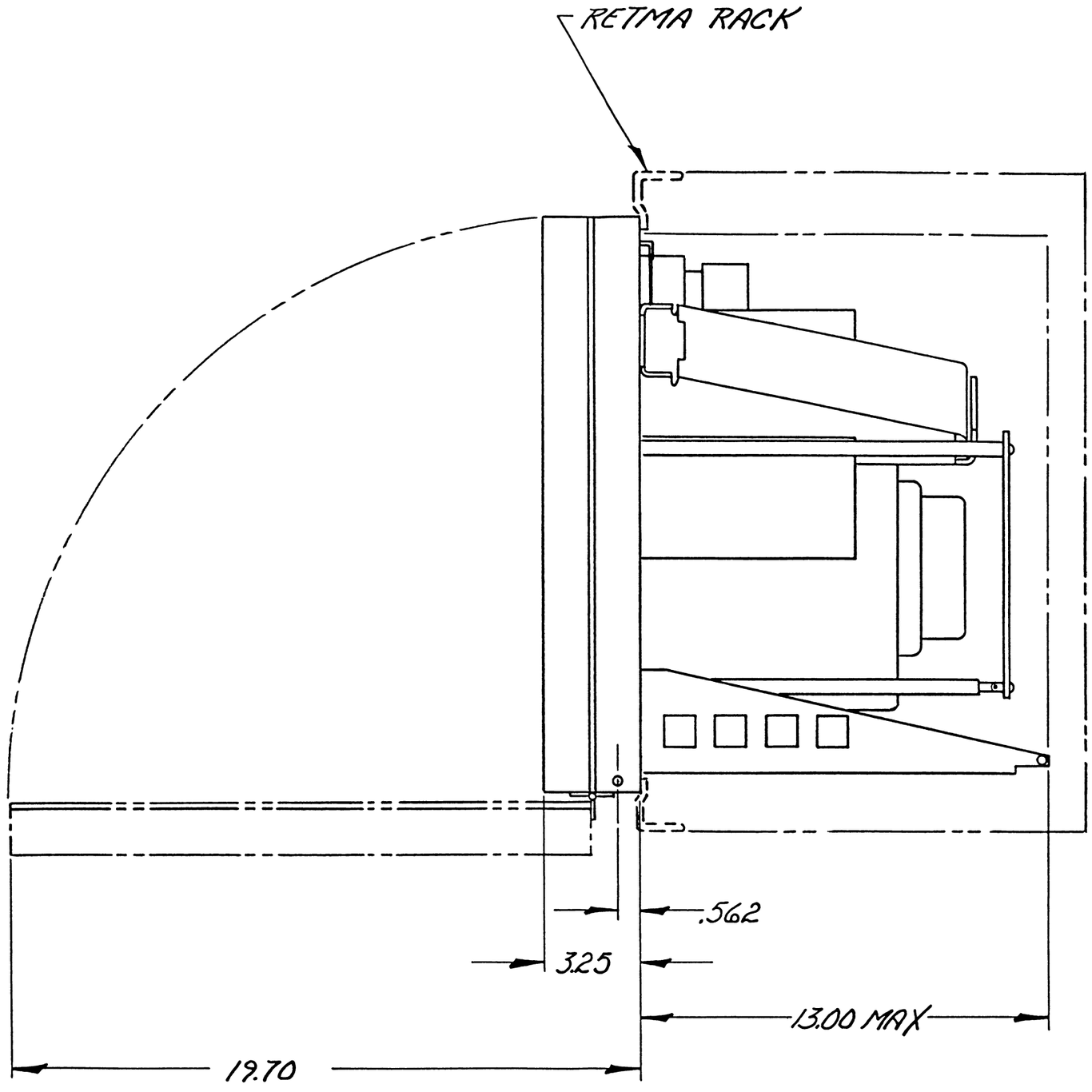

Figure 2-1. Model 900X Outline Dimensions (Sheet 2)

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f. Check that adjustable pawl fastener engages behind equipment rack. Adjust if necessary.

2-12. INTERFACE CONNECTIONS

2-13. Optimally, interconnection of Cipher Data Products and customer equipment should be made with a harness of individual twisted pairs, each with the following characteristics:

a. Maximum length of 20 feet.

b. Not less than one twist per inch.

c. A 24-gauge conductor with minimum insulation thickness of 0.01 inch.

2-14. Alternatively, flat ribbon cable can be used, with some signal degradation, in low-noise environments.

2-15. It is important that the ground side of each twisted pair be grounded within a few inches of the driver to which it is connected. The mating connectors (ELCO part number 00-6007-036-980-002 or equivalent) must be wired by the customer. Interface signals are routed directly to and from the printed circuit boards. Strain relief should be provided. Table 2-1 shows the input/output lines required.

CONNECTOR	LIVE PIN	GROUND PIN	SIGNAL
Input Commands J101	J	8	Select 0 (ISLT0)
	A	8	Select 1 (ISLT1)
	18	8	Select 2 (ISLT2)
	V	8	Select 3 (ISLT3)
	C	3	Synchronous Forward Command (ISFC)
	E	5	Synchronous Reverse Command (ISRC)
	H	7	Rewind (IRWC)
	L	10	Off Line (IOFC)
	K	9	Set Write Status (IWEN)
	B	2	Overwrite (IOVW)
	D	4	Data Density Select (DDS)
Output Indications J101	T	16	Ready (RDY)
	M	11	On Line (IONLS)
	N	12	Rewinding (IRWDG)
	U	17	End of Tape (EOT)
	R	14	Load Point (ILP)
	P	13	File Protect (IFPT)
	F	6	Data Density Indicator (IDDI)
	S	-	+5V (Optional)
Write Inputs J102	A	1	Write Data Strobe (WDS)
	C	3	Write Amplifier Reset (WARS)

Table 2-1. Interface Connections

CONNECTOR	LIVE PIN	GROUND PIN	SIGNAL
Write Inputs J102 (Continued)	F	6	Read Threshold 2 (RTH2)
	L	10	Write Data Parity (WDP)
	M	11	Write Data 0 (WD0)
	N	12	Write Data 1 (WD1)
	P	13	Write Data 2 (WD2)
	R	14	Write Data 3 (WD3)
	S	15	Write Data 4 (WD4)
	T	16	Write Data 5 (WD5)
	U	17	Write Data 6 (WD6)
	V	18	Write Data 7 (WD7)
Read Outputs J103	2	B	Read Data Strobe (RDS)
	1	A	Read Data Parity (RDP)
	3	C	Read Data 0 (RD0)
	4	D	Read Data 1 (RD1)
	8	J	Read Data 2 (RD2)
	9	K	Read Data 3 (RD3)
	10	L	Non-Return-to-Zero (NRZ)
	14	R	Read Data 4 (RD4)
	15	S	Read Data 5 (RD5)
	17	U	Read Data 6 (RD6)
	18	V	Read Data 7 (RD7)

Table 2-1. Interface Connections (Continued)

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SECTION III

OPERATION

3-1. GENERAL

3-2. This section describes the controls and indicators and provides instructions for operating the Model 900X transport.

3-3. CONTROLS AND INDICATORS

3-4. Figure 3-1 shows the controls and indicators. An ON/OFF rocker switch (not shown) is located near the bottom of the control panel. Control/indicator types, functions, and the conditions required for enabling the corresponding functions are given in Table 3-1.

NOTE

The head and guide-cleaning procedures described in paragraph 5-4 must be performed daily to maintain transport reliability.

3-5. LOADING TAPE

3-6. To load tape, proceed as follows:

a. Pull out reel-locking lever on supply hub. Ensure that tape reel has write enable ring installed if Write mode is to be utilized. Place reel of tape on hub so that tape will unwind when reel is rotated in clockwise direction. Press reel evenly and firmly against hub's back flange and push in locking lever. Spin reel counterclockwise while looking along its rim to ensure even mounting.

b. Actuate ON/OFF switch.

c. Thread tape along path shown on facade. Wrap several turns counterclockwise around takeup reel. Check that tape is correctly seated on guides and properly threaded through photosensor and head assembly.

CAUTION

Ensure that tape is positioned correctly on all guides, or tape damage may result.

d. Close front cover to protect tape and transport from dust.

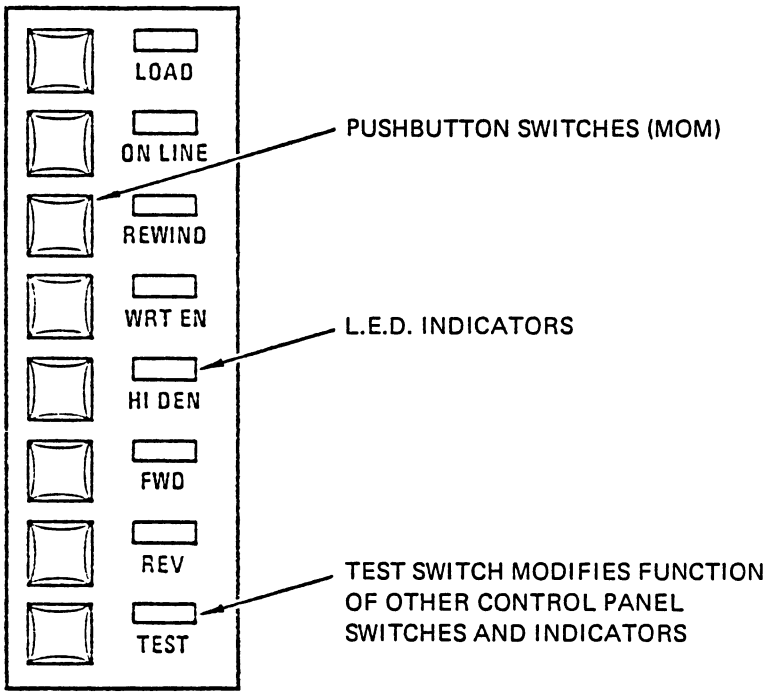


Figure 3-1. Control Panel

CONTROL OR INDICATOR	TYPE	FUNCTION	CONDITIONS
POWER	ON/OFF Rocker Switch	Switches line power on and off.	Fuse installed. Line cord connected.
LOAD	Momentary-Action Pushbutton and Indicator	Illuminates to indicate BOT tab is positioned at photosensor.	Power restored after being off. Loss of tape tension.
ON LINE	Momentary-Action Pushbutton and Indicator	Switches transport to on-line mode. Illuminates to indicate transport is on line.	Initial Load or Rewind actuation. Transport in off-line mode. (ON LINE indicator extinguished).
		Second actuation switches transport off line. Indicator extinguished to indicate transport is off line.	Transport in on-line mode. (ON LINE indicator illuminated).
REWIND	Momentary-Action Pushbutton and Indicator	Rewinds tape to load point. REWIND indicator illuminates during rewinding, then goes out.	Transport in off-line mode. (ON LINE indicator not illuminated.)
		Load indicator illuminates to indicate BOT tab is positioned at photosensor.	
		Second actuation of REWIND pushbutton unloads tape.	

Table 3-1. Controls and Indicators

CONTROL OR INDICATOR	TYPE	FUNCTION	CONDITIONS
WRT EN (Write Enable)	Indicator	Illuminates to indicate write function may be performed.	Tape reel with write enable ring installed mounted on supply hub.
HI DEN (High Density)	Momentary-Action Push-button and Indicator	First actuation (indicator illuminated): PE mode; second actuation (indicator extinguished): lower density (NRZI).	Executed by FWD or REV command following HI DEN actuation.
FORWARD	Pushbutton and Indicator	Starts/stops tape forward motion. Illuminates to indicate transport in forward mode.	Transport in off-line mode (ON LINE indicator extinguished).
REVERSE	Pushbutton and Indicator	Starts/stops tape reverse motion. Illuminates to indicate reverse mode.	Transport in off-line mode (ON LINE indicator extinguished.)
TEST	Pushbutton and Indicator	Selects alternate operational mode for other switches.	

Table 3-1. Controls and Indicators (Continued)

CAUTION

Dust cover must remain closed at all times when tape is on takeup reel. Data reliability may be impaired by contaminants if cover is left open.

f. Actuate LOAD pushbutton and observe that tape is tensioned, as shown in Figure 1-1, and advances until BOT tab is positioned at photosensor. LOAD indicator will illuminate, indicating transport is ready for use.

3-7. UNLOADING TAPE

3-8. To unload the tape, proceed as follows:

NOTE

Tranport must be in off-line mode (ON LINE indicator extinguished).

a. If power is off, actuate POWER switch and proceed to step b. If power is on. Start with step c.

b. Actuate LOAD pushbutton to tension tape.

c. Actuate REWIND pushbutton. REWIND indicator will illuminate. If tape is at load point, tape will be unloaded from vacuum columns and rewound at low speed. If tape is not at load point, rewind ceases when BOT tab is reached. BOT tab is then positioned automatically at photosensor, and LOAD indicator illuminates. Actuate REWIND pushbutton second time to complete unload sequence.

3-9. INTERFACE DATA

3-10. Interface specifications are presented in paragraph 1-24. Interface inputs and outputs are listed in Tables 3-2 and 3-3, respectively.

3-11. MULTIPLE-TRANSPORT (DAISY-CHAIN) SYSTEM MODIFICATION. When two or more transports are used in a "daisy-chain" system, the transmission line (cable) terminators in all transports except the last in the system must be removed, or the resulting impedance mismatch will cause undesirable signal reflections in the cable. The termination impedance networks in the Model 900X transport are all incorporated in one 330-ohm, one 220-ohm, and one 220/330-ohm resistor packs which plug into integrated circuit sockets. The 220/330-ohm pack is mounted on the data PWB, the others on the control/servo PWB. For multiple-transport operation, simply remove the three resistor packs from their sockets on all but the last transport.

INPUT	TYPE	FUNCTION
*Select i (SLTi)	Level	When true, enables all interface drivers and receivers in transport, thus connecting transport to controller.
Sync Forward Command (SFC)	Level	When true, with transport ready and on line, causes tape to move forward at specified speed.
Sync Reverse Command (SRC)	Level	When true, with transport ready and on line, causes tape to move in reverse at specified speed.
Rewind (RWC)	Pulse	With transport ready and on line, this pulse causes tape to move in reverse at 300 ips to BOT.
Off-Line (OFFC)	Level or Pulse (min. width, 1 microsecond)	Resets on-line flip-flop to 0 state, placing transport under manual control.
Write Data Strobe (WDS)	Pulse (min., 1 micro-second)	Trailing edge triggers code generator in transport.
Write Data (WD)	9 lines for 9-track; 7 lines for 7-track	When true from 0.5 microsecond before leading edge to 0.5 microsecond after trailing edge of Write strobe, results in recording of flux transition when in write mode.
Set Write Status (WEN)	Level	When true for 20 microseconds, minimum, after leading edge of FORWARD command, initiates write mode of operation.
Write Amplifier Reset (WARS)	Pulse (min., 2 micro-seconds)	When true, resets write amplifier circuits on leading edge. Purpose is to write LRCC at end of record, causing all channels to be erased in IRG.
Data Density Select (DDS)	Level	When true, conditions read electronics to operate at high density or PE. When false, operation is at low-density mode (NRZI).

*When optional unit select is used, i = switch setting. Otherwise, SLT0 must be true.

Table 3-2. Interface Inputs

INPUT	TYPE	FUNCTION
Overwrite (OVW)	Level	When true, conditions appropriate circuitry, in conjunction with Write Reset (WRS) pulse, for updating (rewriting) of select record. Transport must be in write mode.

Table 3-2. Interface Inputs (Continued)

INPUT	TYPE	FUNCTION
On-Line	Level	When true (on-line flip-flop) set), transport is under remote control. When false, transport is under local control.
Read Data (RD) (RDP, RD0-7)	Bits	Sampling of RDP, RD0-7 simultaneously on trailing edge of Read Data Strobe (RDS) provides complete data character. (In phase encode, these lines are self clocking.)
Read Data Strobe (RDS) (NRZI only)	Pulse (min., 2 µs)	Provides complete data character when RDP, RD0-7 sampled on trailing edge.
End of Tape (EOT)	Level	True for duration of EOT tab. Transitions to and from true state not to be assumed clean.
Data Density Select (DDS)	Level	True only when manual HI DEN switch on transport is set for high density.
Ready (RDY)	Level	True when load sequence is complete and transport is on line and not rewinding. (Transport ready to receive remote command.)
Load Point (LDP)	Level	True when BOT tab is under photosensor, initial load sequence is complete, and transport is not rewinding.

Table 3-3. Interface Outputs

INPUT	TYPE	FUNCTION
Rewinding (RWD)	Level	True only when transport is engaged in rewind operation.
File Protect (FPT)	Level	True when power is on and reel of tape without write ring is mounted on transport.
NRZI Transport Identification (NRZ)	Level (Optional)	True when transport is configured for NRZI data. False level indicates phase-encode configuration.
7-Track Head Identification (7TR)	Level (Optional)	True for 7-track transport; false for 9-track configuration.
Single-Gap Head Identification (SGL)	Level (Optional)	True when transport has single-gap head; false level indicates dual-gap head.
Transport Speed Identification (SPD)	Level (Optional)	True when transport has lower of two speeds available in multiple-transport system.

Table 3-3. Interface Outputs (Continued)

SECTION IV

THEORY OF OPERATION

4-1. GENERAL

4-2. The basic concepts of digital recording, magnetic tape transport applications, and principles of operation of the Model 900X dual-mode transport are presented in this section. A thorough knowledge of this section will be of considerable value to the user in operating and, if necessary, in troubleshooting this equipment.

4-3. BASIC CONCEPTS OF DIGITAL RECORDING

4-4. The use of magnetic tape as a digital recording medium has increased steadily as a result of the increased use of digital techniques and the increasing versatility and decreasing cost of tape transports. The digital recording process involves methods and equipment capable of recording and reading information expressed in a digital (binary) code (various combinations of 1's and 0's).

4-5. DATA RECORDING/READING WITH MAGNETIC TAPE

4-6. The recording of data on magnetic tape originates with the input device, whose nine channels of digital signals are transmitted to the corresponding data channels of the transport. (One of these channels is the parity channel, which is used to detect and correct errors. The remaining channels correspond to actual encoded data to be recorded.) These signals produce corresponding electrical currents in the write head of the transport, which, in turn, produces positive and negative magnetic polarities corresponding to the original data and parity signals in the tracks of the tape passing over it.

4-7. In NRZI systems, a binary 1 signal in a given channel produces a transition from plus to minus (or vice versa) saturation magnetism (+SAT and -SAT, Figure 4-1) in its track on the tape, whereas a binary 0 signal produces no change in magnetism in its track. In phase-encode writing, a binary 1 signal produces a transition to the IBG polarity on the tape when running forward (Figure 4-2); a binary 0 produces a transition away from IBG.

4-8. As a written tape passes across the magnetic read head of a transport, the head responds to each change of flux arriving at its gap and produces a read voltage waveform for each track such as illustrated in Figure 4-1 (NRZI) or Figure 4-2 (PE). (See paragraph 4-14 for a detailed description of magnetic tape recording/reading in the NRZI mode, paragraph 4-22 for phase-encode.)

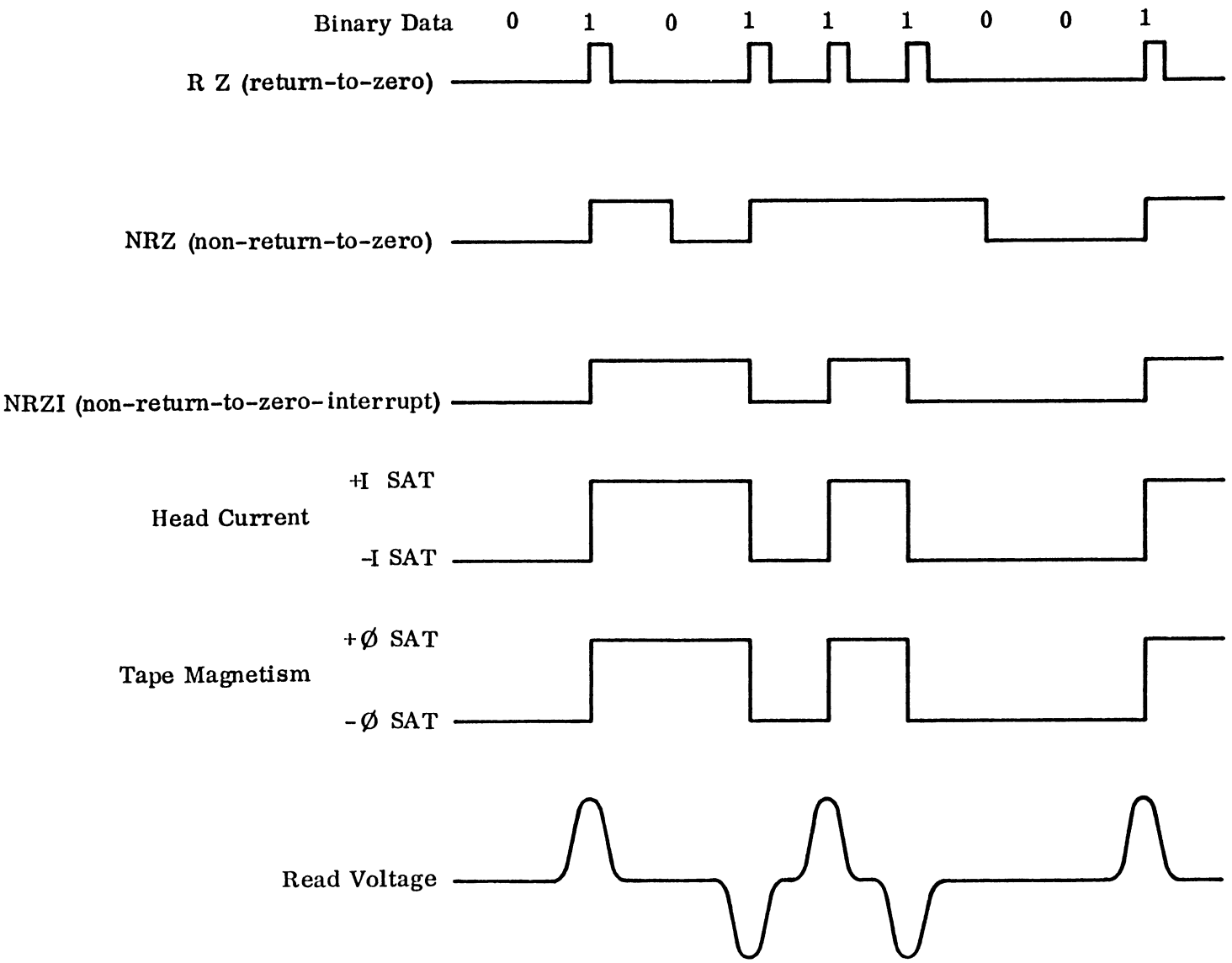


Figure 4-1. Magnetic Recording Waveforms

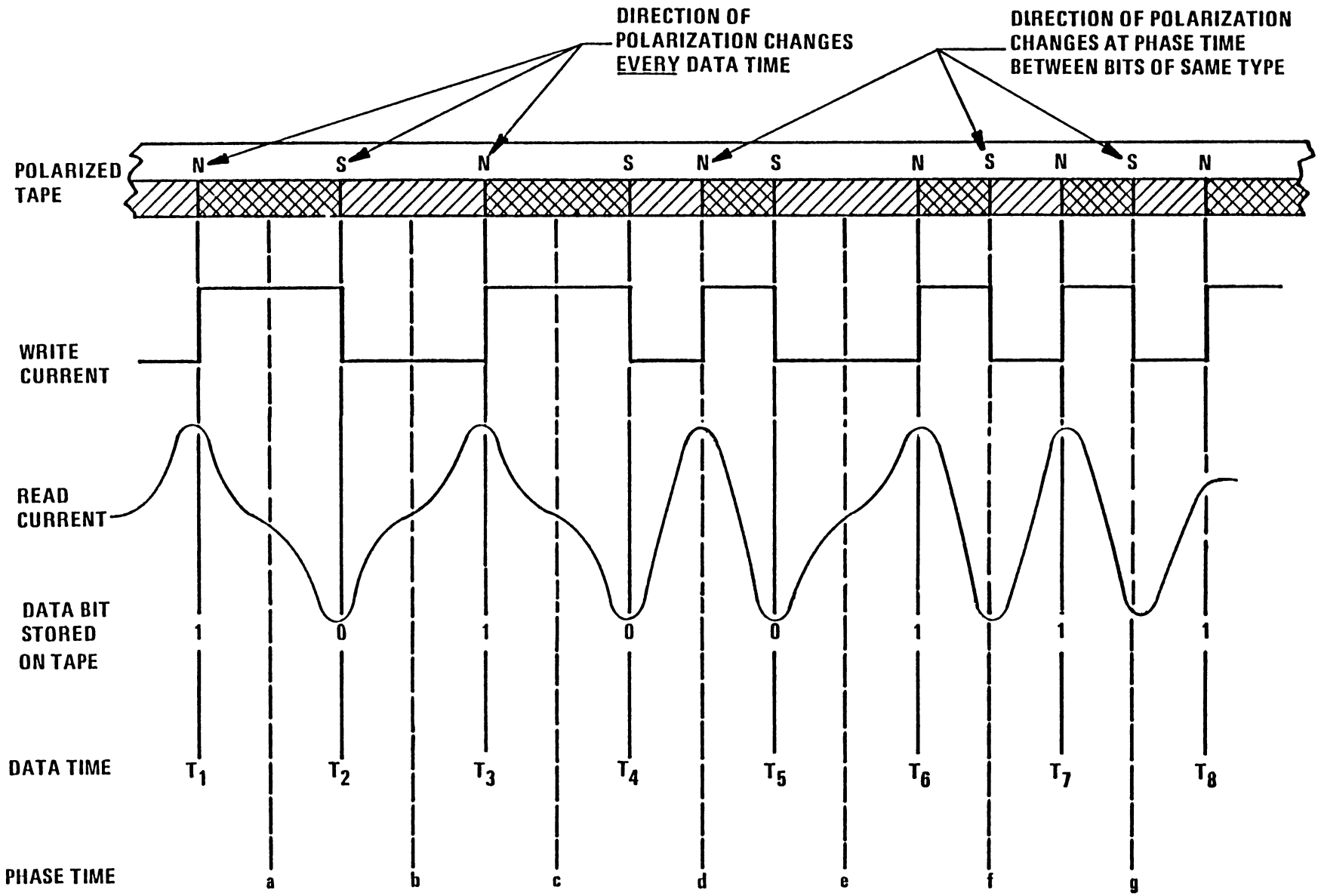


Figure 4-2. Phase-Encoded Tape Magnetization

4-9. MAJOR TRANSPORT COMPONENTS

4-10. The Cipher Model 900X transport is composed of four main assemblies (Figure 4-3): the drive assembly, which includes the tape drive components and the vacuum buffer system; the read/write system, consisting of a head assembly and a dual-mode data board; a control/servo board containing the transport control circuitry, the reel and capstan motor servos, and the power supply regulator circuits; and a power supply, consisting of the power transformer mounted on the rear of the mounting plate, the power supply assembly, and the front-panel-mounted power switch.

4-11. The schematic diagrams in Section VII should be referred to in studying circuit descriptions presented in this section.

4-12. HEAD ASSEMBLY

The Model 900X dual-mode transport has a dual-gap head for read-after-write operation. Track locations, track width, and gap separation are all IBM-compatible (Table 4-1).

4-13. The head has a hard chrome face that is guaranteed for 5000 hours of operating life.

4-14. NRZI CODING SYSTEM

4-15. In the NRZI system, recording is carried out by a saturation current driven through the head in a direction determined by a flip-flop which toggles for each 1 bit recorded. The NRZI system requires the recording of at least one bit for every character. Otherwise, in an all-0 character there would be no indication of the presence of that character.

4-16. NINE-TRACK CODING. Any 8-bit code, such as ASCII or EBCDIC, may be used. (See Figure 4-4.)

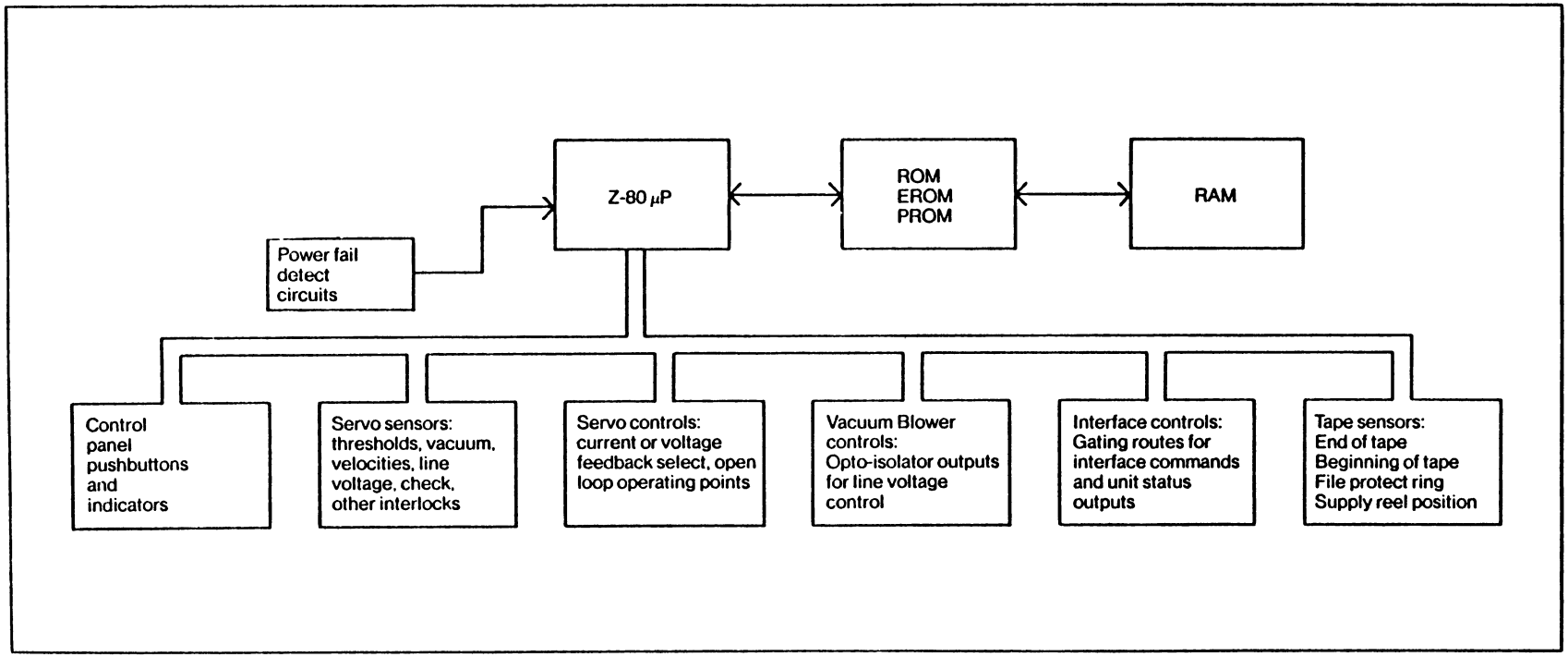
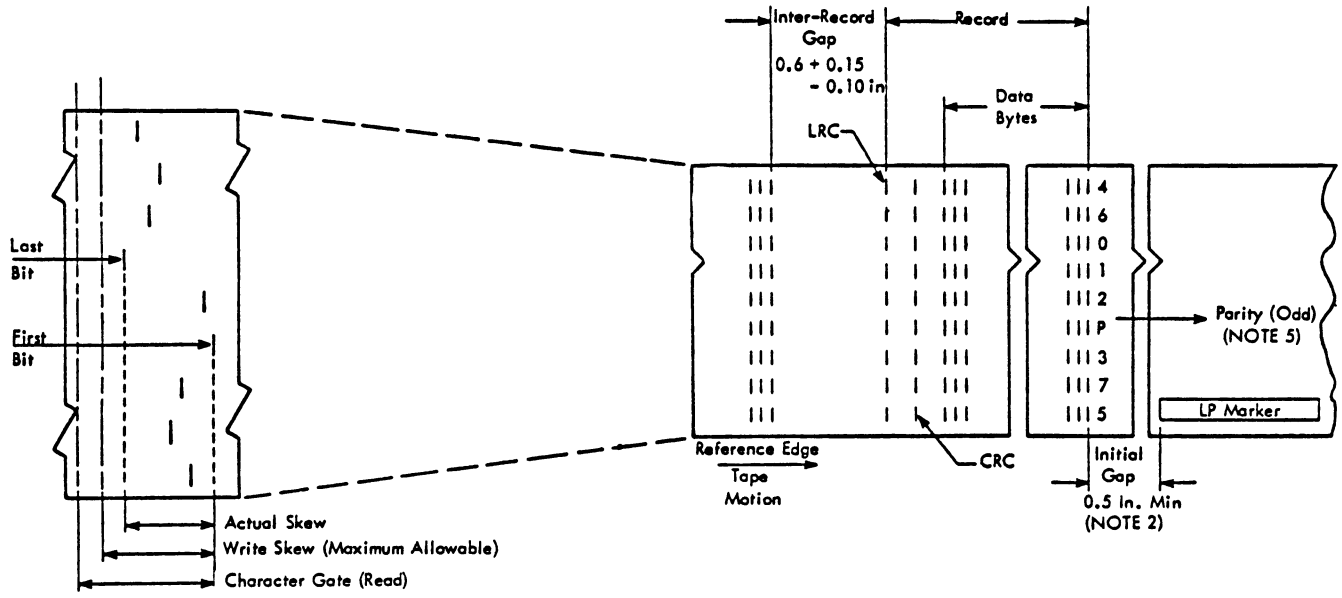


Figure 4-3. Recorder Organization

FUNCTION	DUAL-GAP READ AFTER WRITE
Track Locations	0.055(±0.001) inch, center to center
Effective Track Width	Write: 0.044(±0.001) inch Read: 0.040(±0.001) inch
Parallelism	±200 microinches (write to read)
Gap Separation (Write-Read)	0.150(±0.005) inch
Gap Line Azimuth Per Section	±150 microinches, maximum, from reference perpendicular to mounting surface
Gap Scatter Per Section	100 microinches, maximum
Crosstalk Read	2%, maximum, of nominal read voltage
Voltage Induced in Read Winding While Writing at 800 bpi	5%, maximum, of read voltage
Inductance	Write: (each leg) 300 µH, maximum Read: (each leg) 2 mH, maximum
Dc Resistance	Write: (each leg) 5 ohms maximum Read: (each leg) 10 ohms maximum
Write Current (100% saturation)	50 (±2) mA, NRZI; 30 (±1) mA, PE
Read Voltage	15 (±20%) mV P-P, 45 ips, 800 frpi, no load (read while write)
Self Erasure (Read Signal Reduction After 10 Passes)	10%, maximum
Erase Head Resistance	80 ohms
Erase Current	50 mA

Table 4-1. Head Specifications



NOTES:

1. Tape shown with oxide side down; NRZI recording. Bit produced by reversal of flux polarity. Tape fully saturated with each direction.

2. Tape to be fully saturated in erased direction in initial gap and inter-record gap; tape to be magnetized so that rim end of tape is north-seeking pole.

3. CRCC: cyclic redundancy check character. Parity of CRCC determined by number of data characters in record. Odd number of data characters, even CRCC, etc. CRCC is spaced four bits from data characters.

4. LRCC: longitudinal redundancy check character, always odd parity. Spaced four bits from CRCC. Written with RES line.

5. Parity bit: vertical parity bit written for each data character containing even number of bits.

Figure 4-4. Nine-Track Data Format

4-17. LONGITUDINAL REDUNDANCY CHECK CHARACTER (LRCC). A longitudinal parity bit is written at the end of each record. This character is written by the return of the write head current to the reference condition.

4-18. Since the reference condition is established before the first character of the record and reestablished by writing of the LRCC, an even number of 1 bits in each track is written for each record. As the tape is read, the number of 1's read in each track is counted. If the sum is odd, an error is indicated. The LRCC is spaced four character spaces from the end of the block.

4-19. CYCLIC REDUNDANCY CHECK CHARACTER (CRCC). Nine-track, 800-bpi tapes include a CRCC located at the end of each record before the LRCC. The CRCC is generated by application of a modulo two polynomial of the data within the block.

4-20. This character makes the probability of an undetected error almost zero. The CRCC may be used with the computer read function to determine which track contains the error.

4-21. The information supplied by the CRCC, combined with that of the LRCC and vertical parity, may be used to correct detected errors. Errors involving more than one track within the same record are not correctable. All data and LRCC characters must have odd parity. However, the CRCC character may have either odd or even parity, and in fact, may be all 0's. Allowance must be made in the formatter electronics for the all 0's CRCC condition, since a read clock will not be returned from the drive.

4-22. PHASE-ENCODE SYSTEM. The differences between phase-encoded (PE) and NRZI writing are chiefly in presentation and phasing or coding. In NRZI coding, a single change of polarization on the tape represents a logical 1, while no change represents a logical 0. In PE writing, both the logical 1 and 0 involve changes in polarization. Phasing, however, is the key difference between PE and NRZI, The major advantages offered by PE are reduced possibility of losing data because of inadequate signal strength (making practical low read thresholds) and the fact that each track is self-clocking, reducing skew problems. PE writing is done only in a nine-track mode. Basic features of the PE system are as follows (Figure 4-2):

a. A change in tape polarity at the interface from negative to positive is a 1 bit.

b. A change from positive to negative is a 0 bit.

c. There must be a change of polarity between data bits of the same polarity (consecutive 1 or 0 bits) at phase time.

d. Data density in a PE transport is 1600 bits per inch (bpi) of tape travel.

4-23. For clarification, the term "change of polarity" is also referred to as a flux change or flux reversal. Henceforth, a change from negative to positive will be referred to as a positive flux reversal; positive to negative, a negative flux reversal. As noted above, there must be a flux reversal with each data bit, whether it be a 0 or 1. Therefore, 1600 bpi equates to a minimum of 1600 frpi in any given channel. (This would occur in the case of alternate 0 and 1 bits.) The maximum case would occur with consecutive 0 or 1 bits, resulting in 3200 frpi. The flux reversal at each bit time accounts for the self-clocking feature of PE writing.

4-24. Formatting. Phase-encode formatting is illustrated in Figure 4-5. The format includes an inter-record gap (IRG) and file gap (FG), a data generation and file mark, and identification burst. A block of PE data is preceded and immediately followed by a burst of bytes designated preamble and postamble, respectively. The sequence for a block of PE data is as follows:

a. Forty bytes of all 0's (including the parity bit).

b. One byte of all 1's (including the parity bit).

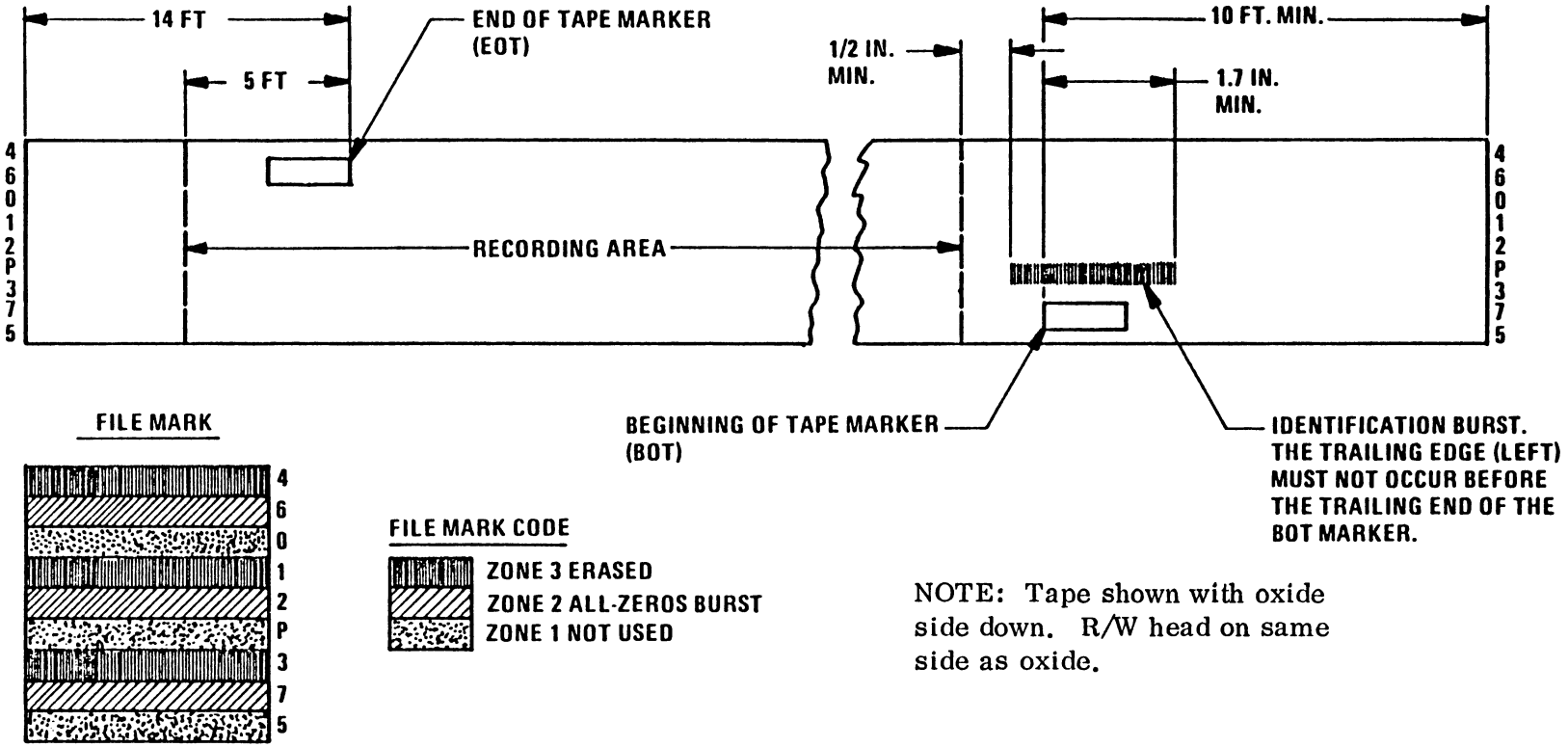
c. Data bytes.

d. One byte of all 1's.

e. Forty bytes of all 0's.

4-25. A phase-encoded tape requires an identification burst of 1600 frpi in the P channel and erasure in all other channels at the beginning of the tape. The burst must begin at least 1.7 inches ahead of the edge of the beginning of tape (BOT) marker and extend beyond the trailing edge of the marker. The load gap requirements are the same as those for NRZI, except that the 0.5-inch minimum gap is referenced from the identification burst. The typical distance for a load gap is 3.75 inches.

4-26. The PE file mark or tape mark consists of 80 flux reversals at 3200 frpi, written in channels 2, 6, and 7, with channels 1, 3, and 4 dc erased. Channels 0, 5, and P, in any combination, may be dc erased or recorded the same as channels 2, 6, and 7.



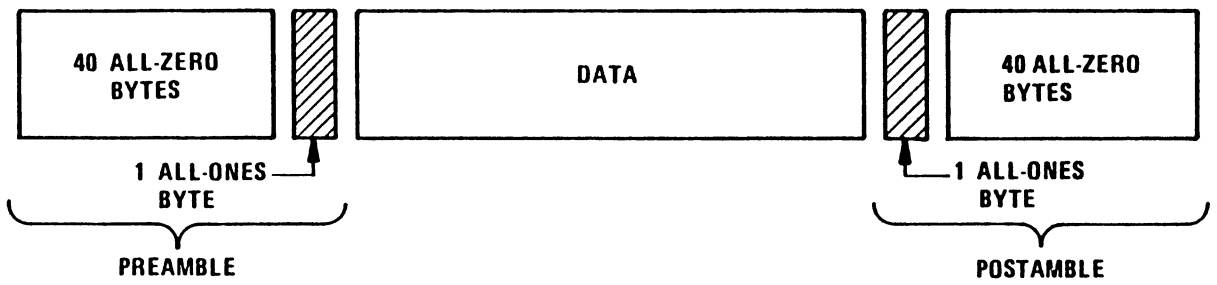


Figure 4-5. Phase-Encoded Tape Block Format

4-27. DUAL-MODE DATA BOARD THEORY (Drawing No. 354040-300)

4-28. CONTROL SECTION (Sheet 5). The data board control section consists of the following circuits:

a. Read threshold offset voltage.

b. PE or NRZI selection.

c. Transport select.

d. Voltage regulators.

e. Write voltage control.

4-29. The threshold circuitry selects a high read threshold when writing. RTH2 selects an extra low read threshold, which is needed for reading old tapes. The threshold voltages are determined by resistors R14, R15, R25, R21, and R20. The voltage varies in relation to S2 (4-11), S2 (5-10), $\overline{\text{RTH2}}$, and $\overline{\text{READ}}$. The transistor driven by U17-12 allows some current to be shunted to ground through R16. This transistor is on for PE operation, and current being shunted in this manner will reduce the gain of U16-1 by a factor of two-thirds. The outputs of U16 cause the threshold detector of each channel to have a negative or positive offset, depending on whether TH- or TH+ is the input. The highest threshold can be obtained by closing both S2 (4-11) and S2 (5-10). When both switches are open, the lower threshold will be selected. With S2 (4-11) closed and S2 (5-10) open, normal threshold detection is used.

4-30. WRITE VOLTAGE CONTROL (Sheet 5). Control for the write voltage circuit is provided by the low-true NOR gate U114-8. When $\overline{\text{WTEST}}$ or the output of exclusive OR-gate U108-8 goes low, U92-4 goes low. This low causes Q5 to start conducting. The large capacitor, C103, gives the circuit a Miller integrator configuration. C103 charges to +12V through Q5. L4, which consists of ferrite beads, filters the switching noise to prevent it from being applied to the write circuitry. Zener diode CR4 allows the write circuitry to be used with both high- and low-speed tape heads without changing resistor values in the write-head drivers. The high-speed head requires more current, which is provided by closing of SW3 (2-7); this increases the current by about 50%. The write current is supplied to the center tap of the write head.

4-31. Q2 senses the voltage from the center taps of the write head, starts conducting, and supplies current for the erase bar, P21-H. Q6 and Q4 form a protection circuit to eliminate glitches from the write head when the transport is being powered up initially. This could cause data to be erased during the power-on sequence, as in the case of a file-protected tape. Initially, Q4 is on. As the +12 volts increases, the voltage divider action of R284 and R283 will cause the base emitter junction of Q6 to become

back-biased, and Q6 will turn off. With Q4 on, the base of Q5 will not become negative enough to turn on Q5.

4-32. VOLTAGE REGULATORS. There are two voltage regulators supplied on the board. Cipher's tape transports will supply either ±15 volts (Models 70X, 80X, and 100X) or ±12 volts (Model 900X) to the data board. The regulators are used to reduce the ±15 volts to a regulated ±12 volts. SW3 (4-5) and SW3 (3-6) are closed when the dual-mode data board is mounted on the Model 900X tape transport.

4-33. Each channel outputs a signal XINCHI(P-7), which goes to U23-1, an analog majority gate. All nine channels are sensed by U23-3. Channel P has a 10K-ohm resistor, R34, in series, so that the ID burst can be detected. Note also that channels 2, 6, and 7 have smaller value resistors, R36, R30, and R32, permitting the file mark to enable the circuit also. U23-1 will slew to a high after two to three bits have passed through the nine channels. This high is passed through some subsequent logic to provide the control signal Phase Encode Select (PESEL). This control signal enables the PE data output gate, U24-9, in channel P.

4-34. CONTROL SIGNALS. $\overline{\text{RUN}}$ comes from the control/servo board as a low true signal. It passes through inverter U21-4 and triggers a one-shot multivibrator, U2. U2-4 provides a positive, 5-µs pulse. This pulse will clock D-type flip-flop U18. The D input is dependent upon the control signal, $\overline{\text{HIDEN}}$, which comes from the control servo PWB also. Since $\overline{\text{HIDEN}}$ is low true, it causes the data PWB to be PE selected. When $\overline{\text{HIDEN}}$ is high false, it initiates the NRZ mode of operation.

4-35. PE OR NRZI SELECTION. Switches S2 (8-7) and S2 (9-6) control the interface status signal, $\overline{\text{NRZ}}$. When both sections of S2 are open, $\overline{\text{NRZ}}$ is low true. If S2 (9-6) is closed, $\overline{\text{NRZ}}$ will be high false, which causes the PWB to operate in a PE mode. When S2 (7-8) is closed, the control signal $\overline{\text{HIDEN}}$ will control remotely the operable mode of the data electronics.

4-36. WRITE DATA SECTION. The write data section of the dual-mode PWB consists of the following:

a. Write input register.

b. NRZI write deskewing circuitry.

c. WDS and WARS generation circuitry.

d. Write output register.

e. Tape head drivers.

4-37. Referring to Figure 4-6 and sheet 1 of the schematic diagram, Drawing No. 354040-300, the theory presented herein is based

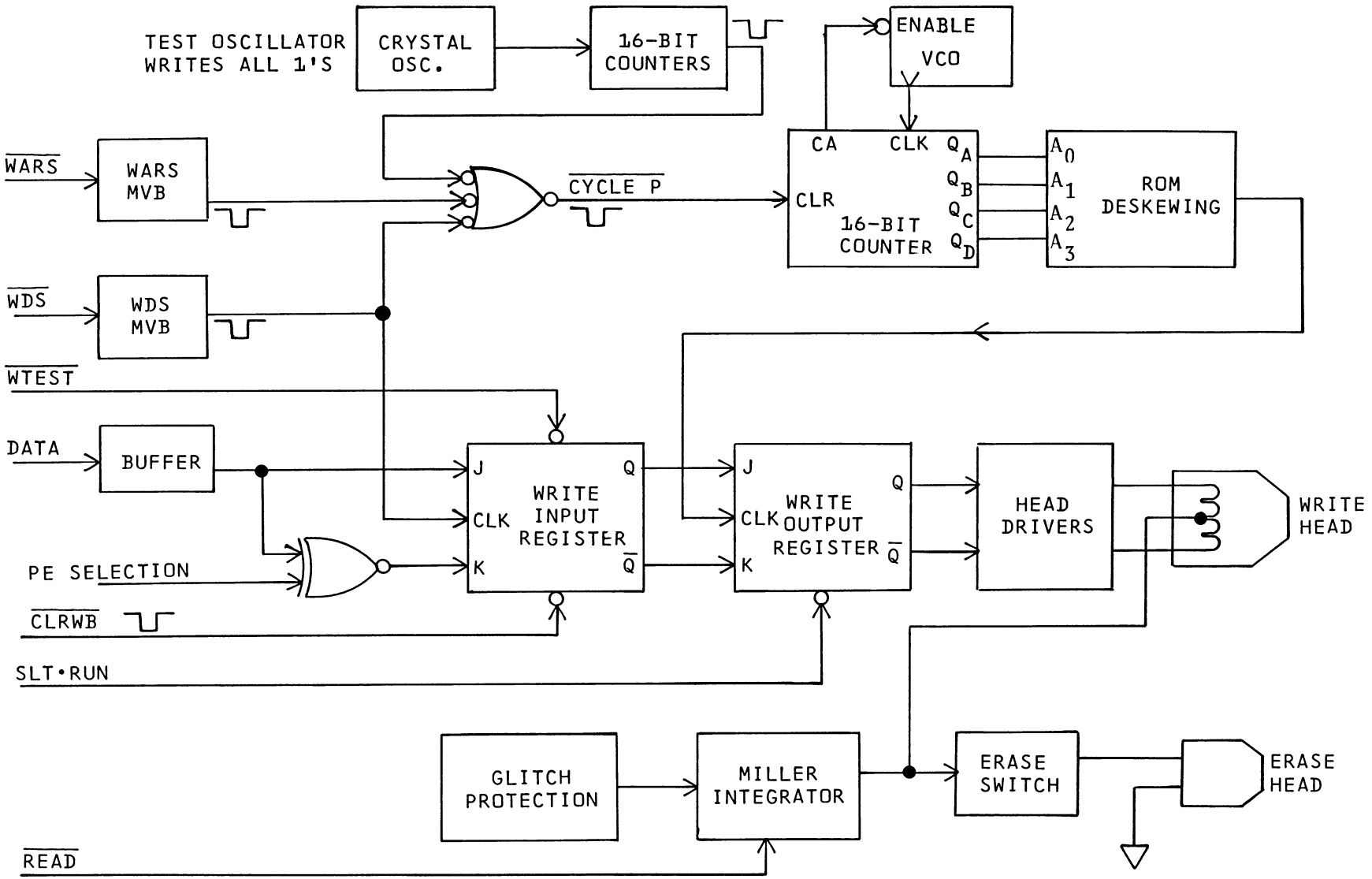


Figure 4-6. Write Data Block Diagram

on channel P but is applicable also to the eight additional channels. The write data interface lines at connector P102 have 220/330-ohm input terminators that provide impedance matching and serve as pull-up resistors for the transmitters at the other end of the data cable. U112-12, a hysteresis receiver, is used to buffer the data lines. The write input register, U105, is used to store the incoming data from the interface. The data is latched into the write input register when Write Strobe ($\overline{\text{WSTRB}}$) occurs. Referring to sheet 5 of the schematic, the Write Data Strobe (WDS) is brought from the formatter/controller. Its frequency is equal to the data rate in the NRZI mode and twice the data rate in the PE mode.

NRZI WDS frequency = speed x 800 bpi

PE WDS frequency = 2 x speed x 1600 bpi

Data rate = speed x bit density

4-38. The WDS enters the data board at P102-A and propagates through U112-6. R259 and C113 provide noise filtering before the WDS fires the one-shot multivibrator, U115-12. The output will be a negative 100-ns pulse, which becomes $\overline{\text{WSTRB}}$ and clocks write input register U112. The exclusive OR gate, U108-3, causes the write input register to operate as a toggling J-K flip-flop in the NRZI mode for each 1 bit or follow the data bits (1's or 0's) in the PE mode, similar in operation to a D-type flip-flop. The control signal, Phase Encode (PE), will direct the exclusive OR gate as to the mode of operation.

4-39. The write output register (U99) will be clocked each data time and will store the data from the write input register, U105. The clock for U99 is derived basically from the WDS also. The output of U115-12 (sheet 5) also goes to the low true NOR gate, U114-4. The output of U114-6 will be a negative 100-ns pulse designated $\overline{\text{CYCLE P}}$. This signal will initialize the operation of the NRZI write deskewing circuit.

4-40. NRZI Write Deskewing Circuit. This feature of the data PWB eliminates the need for nine adjustable one-shot multivibrators. The NRZI deskewing circuits make allowance for the gap scatter present in the write head. Electronically, the writing of each track is adjusted so that the final result is a precise vertical word written on the tape. This makes the data easier to read and improves the read compatibility between tape transports.

4-41. The circuit consists of a voltage-controlled oscillator, U89; synchronous, four-bit counter, U91; and a 256-bit, bipolar, programmable ROM (32x8 PROM), U90. The output frequency of the oscillator is controlled by the external capacitor, C92, which is chosen to match the tape transport speed; the resistor divider consisting of R213 and R212 restricts the frequency range of operation. U89-6 is the chip Enable input and goes low when the $\overline{\text{CYCLE P}}$ signal

asynchronously clears the four-bit counter. The counter controls the address inputs of the PROM. The output of the PROM is all 1's, except for the specific channel that is being written. Channel 2 has a fixed count of eight, provided by exclusive OR gate U109-8. (Channel 2 was picked as the reference channel because it is the center track of the write head.)

4-42. The clock for the counter is supplied by the oscillator. The counter will count from 0 through 15; at this time, the carry output of the counter will disable the oscillator at U89-6. The counter increments on the positive edge of the clock, and the PROM writes on the negative edge. The write skew should hold near 6% of the byte time. (The PROMs will be serialized with the tape head assembly, and they will be replaced as a pair if the need arises.)

4-43. There are four write head drivers following the write output register. The inner two head drivers are used for both PE and NRZI operation, while the outer two head drivers are used only for NRZI operation. P21-N and P21-K are attached to the write head winding with center taps (shown on sheet 5 of the schematic) P21-A, B, D, E, J, M, R, U, X. The control signal, NRZ VCC, is enabled by Q3, which activates the two head drivers, U96-10 and U96-14.

4-44. In the NRZI mode, an extra interface signal is required to write the longitudinal redundancy check character (LRCC) eight character spaces after the last data character. This signal is called Write Amplifier Reset ($\overline{\text{WARS}}$) and enters the data board at P102-C. After propagating through U112-8, it is noise filtered by R258 and C112. The one-shot multivibrator, U115-4, outputs a negative 100-ns pulse to U114-3. This generates the clock for the write output registers. The $\overline{\text{WARS}}$ pulse also passes through U112-10 and U114-12 to give the signal, Clear Write Buffer ($\overline{\text{CLRWB}}$). This pulse is applied to the Direct Clear inputs of the nine write input registers and sets them to a reference condition awaiting the next data character. The reference condition ensures erasure of the tape in the interrecord gap.

4-45. READ SECTION (Figure 4-7 and Sheet 2, Drawing No. 354040-300). The read section of the dual-mode data PWB consists of the following circuits:

a. Nine read amplifiers (PE or NRZI).

b. Signal threshold detection.

c. Phase-encode envelope detection.

d. NRZI Read Data strobe generation.

e. Read output register.

4-46. The read section theory presented herein pertains specifically to the P channel but is applicable to all nine read channels.

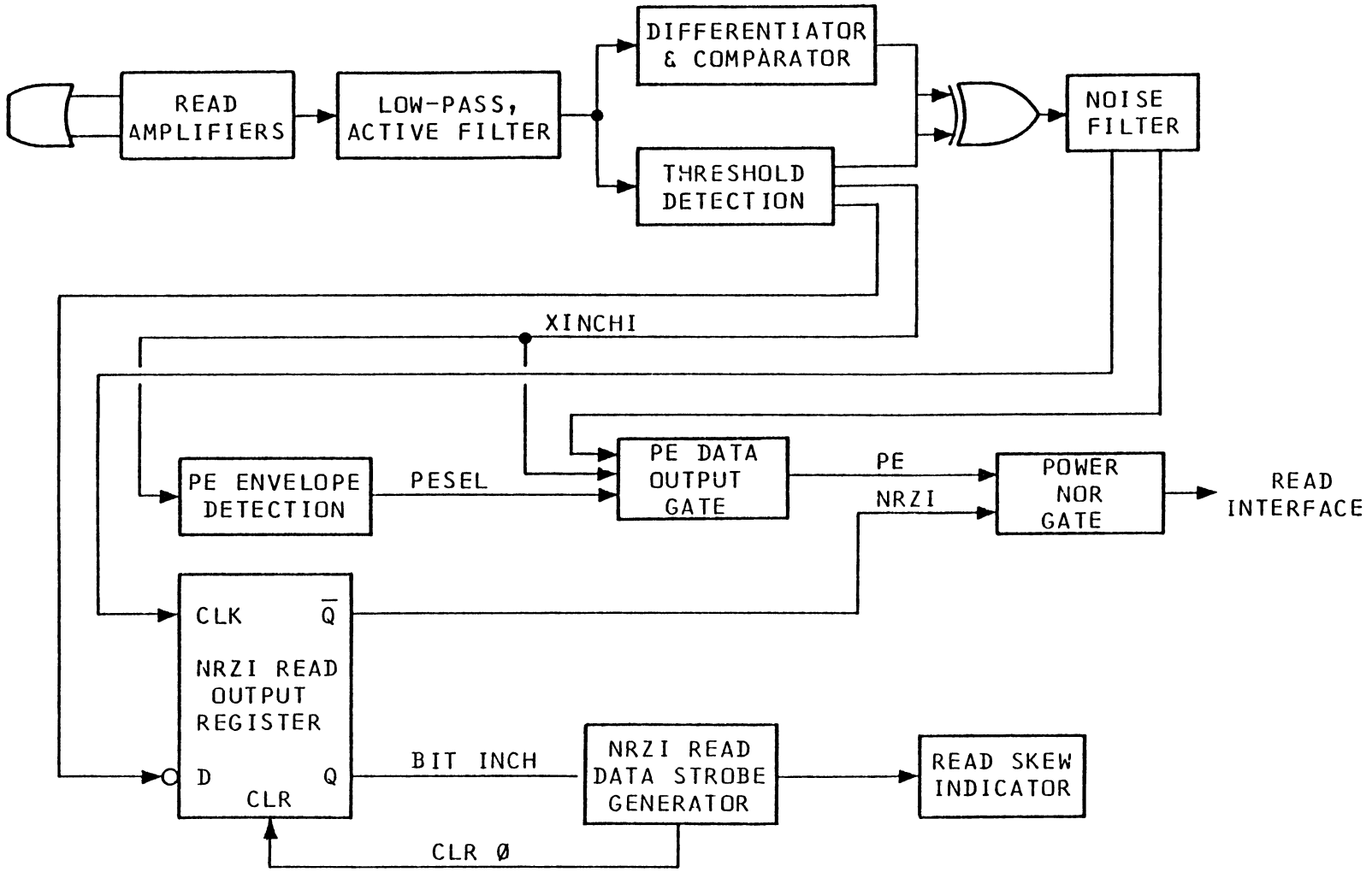


Figure 4-7. Read Data Block Diagram

The first read amplifier (U80) has an approximate gain of 200, a bandwidth of 700 kHz, external frequency compensation, and no crossover distortion. The gain is set by R60 and R63, in the feedback circuit of the general-purpose 709 operational amplifier. The external frequency components, C61, R64, and the 3-pF capacitor (which is intrinsic to the circuit board) do not require changing in the speed range of 12.5 to 125 ips. The read signal from the tape head is offset approximately -12 mV by the resistor divider network, R262 and R263. This is accomplished by connection of the center tap of the read head to this resistive divider. One end of the read head winding is left disconnected, and the other end is tied to the input of the amplifier. (The reason for offsetting the input is to eliminate the crossover distortion commonly present on the output of 709 operational amplifiers. This type of distortion cannot be tolerated in the reading of phase-encode data.) After amplificiation, the offset voltage will be approximately -2.5 volts. Capacitor C60 blocks the dc offset from the input of U33-3.

4-47. The second stage of amplification is a TL082, JFET, input operational amplifier whose characteristics include high input impedance, unity gain bandwidth, internal frequency compensation, continuous short-circuit protection, and low input bias and offset currents. The amplifier has a read gain potentiometer in the feedback circuit. The gain can vary from unity to 11 over a speed range of 12.5 to 125 ips, even with the different read heads. The higher the transport speed, the less the gain required. Therefore, with the lowest gain there will be the greatest bandwidth at 125 ips. High read gain and narrow bandwidth are needed for optimum performance at 12.5 ips. The adjustment of R203 through R211 is the only read gain adjustment for both PE and NRZI operation. This adjustment can best be made by writing all 1's at 800 bpi (NRZI), monitoring TP-30 through TP-38, and setting the signal level for 8 volts peak-to-peak.

4-48. The next stage, U33-7, is a low-pass, active filter. The low-pass elements are R62, R61, and the two capacitors, which change with speed, on header A6. Capacitor C59 and resistor R92 help to maintain a low-input offset voltage. The output of the low-pass filter goes to threshold detectors U27 and comparator U30-7. In the signal path to the comparator is a differentiator consisting of A6 (8-7) and R54. The analog voltage comparator, U30-7, is a type LM311 with some hysteresis. The hysteresis of the comparator is made symmetrical about 0 volts by the positive feedback through R265 and the negative bias supplied through R266. The signal path through R51 goes to the inputs of the dual-voltage comparator, type LM319. The other input to the U27 comparator is tied to the read threshold circuit.

4-49. Threshold detectors U27-7 and U27-12 each have a dc offset voltage tied to U27-10, which is TH-, and U27-4, which is TH+, respectively. The two threshold voltages are set by U16 and associated circuitry (sheet 5 of the schematic). The read signal output of U33-7 is compared with the threshold reference, and when the

positive read signal exceeds the threshold offset, U27-7 will go high. If NRZI mode is selected, the high will be transferred as a low by U31-6. Exclusive OR-gate U37-3 has the input condition of U37-1, which is high, and U37-2 is low when the read signal is a positive peak at U33-7. Thus, the output of U37-3 will be high.

4-50. If the read signal input to U27-9 is a negative peak, then U27-7 would stay low and the state at U37-2 would be high. Hence, the output at U37-3 would be low. The output of the exclusive OR-gate has the characteristic that the signal transition is in the same direction (negative-going) for both positive and negative peaks of the NRZI read signal.

4-51. The next group of components in the signal path consists of R45, A1 (1-14), and R39, which provide filtering action for the switching noise created by low-pass filter U30-7. The signal is inverted and delayed slightly before going to the clock input of U26-3, a D-type flip-flop. The initial condition of U26-6 is low.

4-52. Low true NOR gate U31-3 provides the D input to U26-2. Whenever data has been detected, U31-3 goes high. The signal goes through two inverters and is integrated by R43 and the capacitor on header A1 (7-8). Once the threshold of hysteresis gate U25-5 is reached, the input to D-type flip-flop U26-2 goes low. When the D-latch is clocked, output U26-6 goes high.

4-53. The interface, P103-1, is driven by a power buffer NOR-gate with open-collector output. When either input to U35 goes high, a low is transferred to the interface and interpreted as a 1 bit. The interface remains low until CLRØ clears flip-flop U26. When reading a 0 in the NRZI mode, the D flip-flop is clocked, but the D input, U26-2, is high. Hence, output U26-6 remains low, and the output of NOR gate U35-4 stays high. A high logic level at the interface is interpreted as a 0 bit.

4-54. AND gate U24-8 is used to pass the phase-encode data. The input, U24-9, is the control signal Phase Encode Select (PESEL), which is high true for PE operation. The other input, U24-10, is high when data has been detected in the channel. Low true NOR gate U31-3 goes high and is inverted by U28-12. Capacitor A1 (6-9) was intially charged to +5 volts. After about two bit cells of the preamble, A1 (6-9) is sufficiently discharged to cause U25-8 to go high. For a 1 bit, U24-11 will be high, and NOR gate U35-4 will go low. Just the opposite is true for a 0 bit. The output of U25-8 is the channel envelope detect output for the PE mode, Data In Channel - Phase Encode (XINCHIP).

4-55. The nine-channel envelope detect signals go to U23-1 (sheet 5), an analog majority gate. The analog voltage is varied for some channels by the different resistor values on input U23-3. Channel P has a 10 K-ohm resistor, R34, in series for detection of the identification burst. Note also that chanels 3, 6, and 7

have 33K-ohm resistors in series with the input; thus, a file mark will enable the circuit also. U23-1 will slew to a positive level after two or three bits have passed through the read channels. This high is passed through some subsequent logic to give control signal PESEL, which enables AND gate U24-9 (sheet 1).

4-56. NRZI Read Gate and RDS Generation (Sheet 5, Drawing No. 354040-300). All nine channels generate a signal BITINCH (P-7), which means a NRZI 1 bit has been detected in the respective channel. The first channel to detect data will cause U4-9 to go high. U4 and U13 are configured as a latch, which is reset at CLRØ time. The high at U4-9 goes to the D input of U8-6. U8-9 is clocked by a signal generated from Y1, the crystal oscillator, and is 64 times the data rate in the NRZI mode. The high on the D input is transferred to the Q output, U8-7, at clock time. Note that U8 would be disabled when the data board is PE selected, because a low would be presented on the clear input, U8-1. In the NRZI mode, U8 is enabled. When the Q output is high, the two counters, U12 and U15, are allowed to start counting the clock pulses applied to their clock inputs. Prior to this, the counters are loaded with a set count. The operation of the switches on the lead inputs is as follows: both open, read gate = 12% of byte time; SW1 (1-16) open, SW1 (2-15) closed, read gate = 25% of byte time; SW1 (1-16) closed, SW1 (2-15) open, read gate = 37% of byte time; both closed, read gate = 50% of byte time.

4-57. When the carry output of U15-15 goes high, the next clock pulse will cause the D-type flip-flop, U8-15, to store this high. Three clock times then elapse before U5-12 goes low. On the fourth clock, U8-10 goes high and, with NRZI selected, U9-3 outputs the Read Data Strobe (RDS) to the formatter. The fifth clock time after U15-15 went high initiates CLRØ, which clears the NRZI read output registers. At CLRØ time, the U4-9, U13-6 latch is reset. This latch will now wait for the next BITINCH signal to go true at the next byte time.

4-58. TEST SECTION. The test section of the dual-mode data board consists of the following circuits:

a. Crystal oscillator.

b. Two 16-bit counters.

c. Read skew indicator.

d. Switch settings.

4-59. With the Cipher dual-mode data PWB, it is possible to write all 1's on a tape without the use of external test equipment. There is a visual indication of out-of-tolerance read skew, and a variety of DIP switch settings is available to aid the technician in troubleshooting.

4-60. The test circuitry is located on sheet 5, Drawing No. 354040-300. The crystal, Y1, supplies the clock for two counters, U11 and U7. Each counter contains four flip-flops and a divide-by-eight counter. When SW1 (3-14) is closed, the crystal oscillator frequency will be supplied to the NRZI Read Data Strobe generation circuit and to the divide-by-eight counter clock input, U11-1. When SW1 (4-13) is closed, the crystal frequency will be divided in half before application to the above circuits. Closing of SW1 (5-12) will provide the proper WDS frequency to test write 3200 fci for PE testing. Closing of SW1 (6-11) will provide the proper data rate to test write 800 fci for NRZI testing. When pushbutton SW-4 is closed, the write head and erase bar current are enabled.

CAUTION

Closure of pushbutton SW-4 bypasses all file-protect circuits. To protect test tapes or other needed recorded data, ensure that this switch is closed only when tape erasure is desired or immaterial.

4-61. All tapes will be written with this SW-4 closed. This switch also provides control signal $\overline{\text{W TEST}}$, which goes to the Direct Set inputs of the write input registers shown on sheet 1. The output of the write input registers is such that all 1's are written on the tape.

4-62. The clock for the write output registers is supplied by the output of the second counter, U7. The clock is passed through U10-4, U13-3, and U114-5 to generate $\overline{\text{CYCLE P}}$.

4-63. Another feature of the dual-mode data board is the skew indicator. The one-shot multivibrator, U2, will detect a skew overflow. U2 fires whenever U18-5 goes high, and another BITINCH signal sets the U4-U13 latch after the latch has been reset by a high setting of U8-2. Deskewing of even just one channel will cause the LED indicator to illuminate.

4-64. Closing of SW1 (7-10) allows TP-10 to display the read skew waveform. This will show the read skew within 10% of a byte time for normal operation. The switch should be left open for NRZI operation.

4-65. CONTROL/SERVO PWB

4-66. The control/servo PWB (Figure 4-8) is a multilayer board with a ground plane in the center to reduce system noise and the need for bypass capacitors. It incorporates circuitry for the following:

a. Power supply.

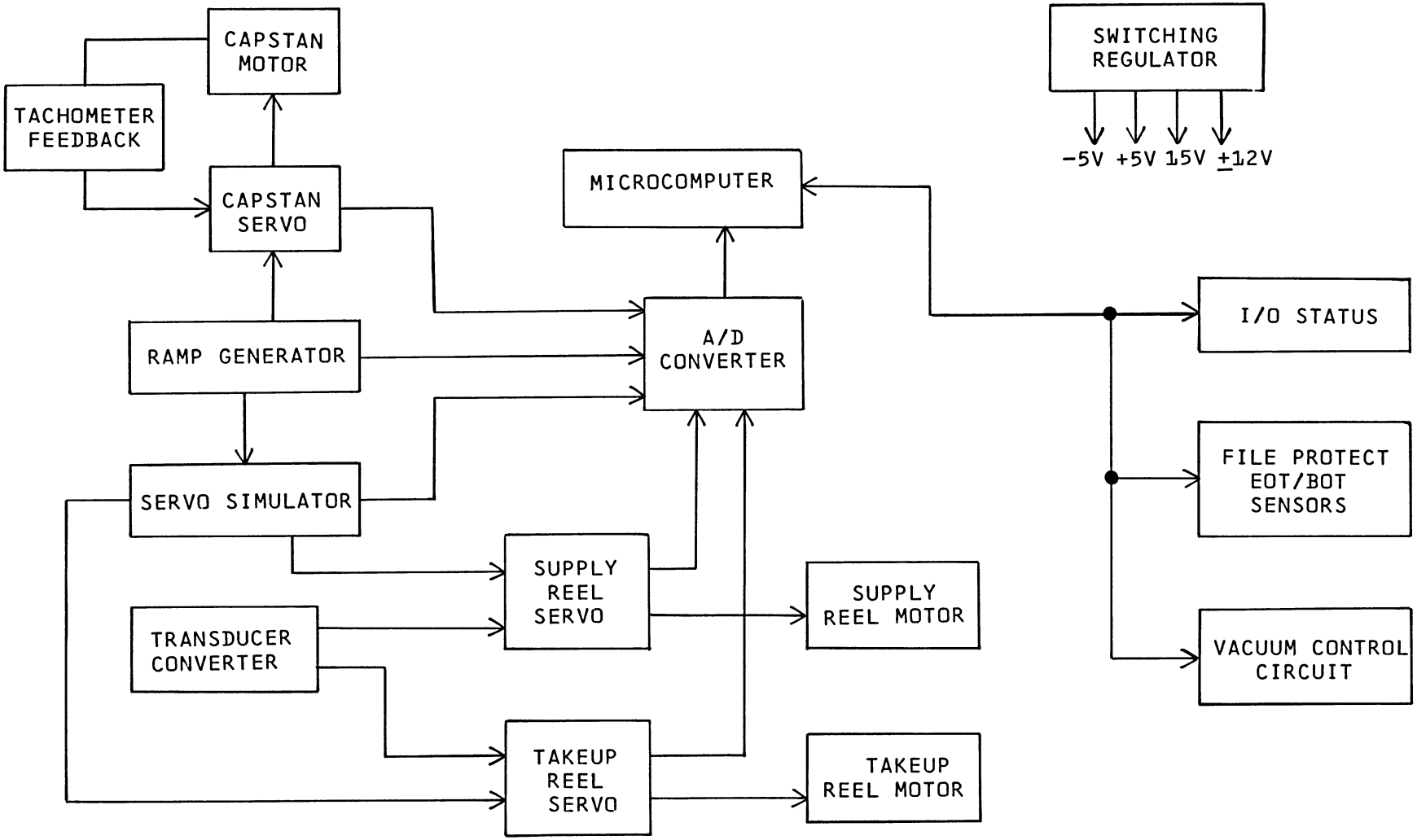


Figure 4-8. Control/Servo PWB, Block Diagram

b. I/O status indication.

c. Microcomputer.

d. Analog-to-digital converter.

e. Vacuum control.

f. Capstan servo control.

g. Servo simulator.

h. Transducer converter.

i. Takeup and supply reel servos.

j. File protect and EOT/BOT sensors.

4-67. POWER SUPPLY. By means of a fixed-frequency, pulse-width-modulation, voltage-regulator control circuit, the power supply produces all required analog and digital supplies from its 48-Vdc input. They consist of ±12- and ±5-volt regulated supplies, which are used also by the data circuitry, as well as an unregulated +15-volt supply. These supplies are short-circuit protected and will execute a reset condition if V_{CC} drops below 30 volts.

4-68. Switching Regulator (Figure 4-9 and Sheet 1, Drawing No. 354012-300). The SG3524 integrated circuit (U97) is a fixed-frequency, pulse-width-modulation, voltage-regulator control circuit. Operating frequency, which is determined by R339 and C168, is 25 kHz. U97 is used in a push-pull circuit configuration in the transformer-coupled dc-to-dc converter.

4-69. Each U97 circuit includes an on-chip regulator, error amplifier, programmable oscillator, pulse-steering flip-flop, high-gain comparator, and current-limit sensing and shutdown circuitry. Voltage regulation is produced by varying the duty cycle of the square-wave outputs at E_A and E_B.

4-70. The square-wave outputs of E_A and E_B are applied to the bases of switching transistors Q56 and Q57, respectively. These transistors turn on and off to supply current to the primary of transformer T4. Q54 and Q55 are normally conducting when output switching transistors Q56 and Q57 are off. This reduces the storage time of the switching transistors, thereby allowing a faster switching rate.

4-71. The secondary of T4 consists of full-wave bridge rectifiers and inductive input filters. The fundamental frequency filtering is accomplished by L7, L8, and L9. Transformers T1, T2, and T3, in conjunction with C160 through C165, filter out the high-frequency noise caused by the switching regulator. The +5-volt output, adjustable by R367, is set at +5.00 (±0.1) volts. The ±12-volt and

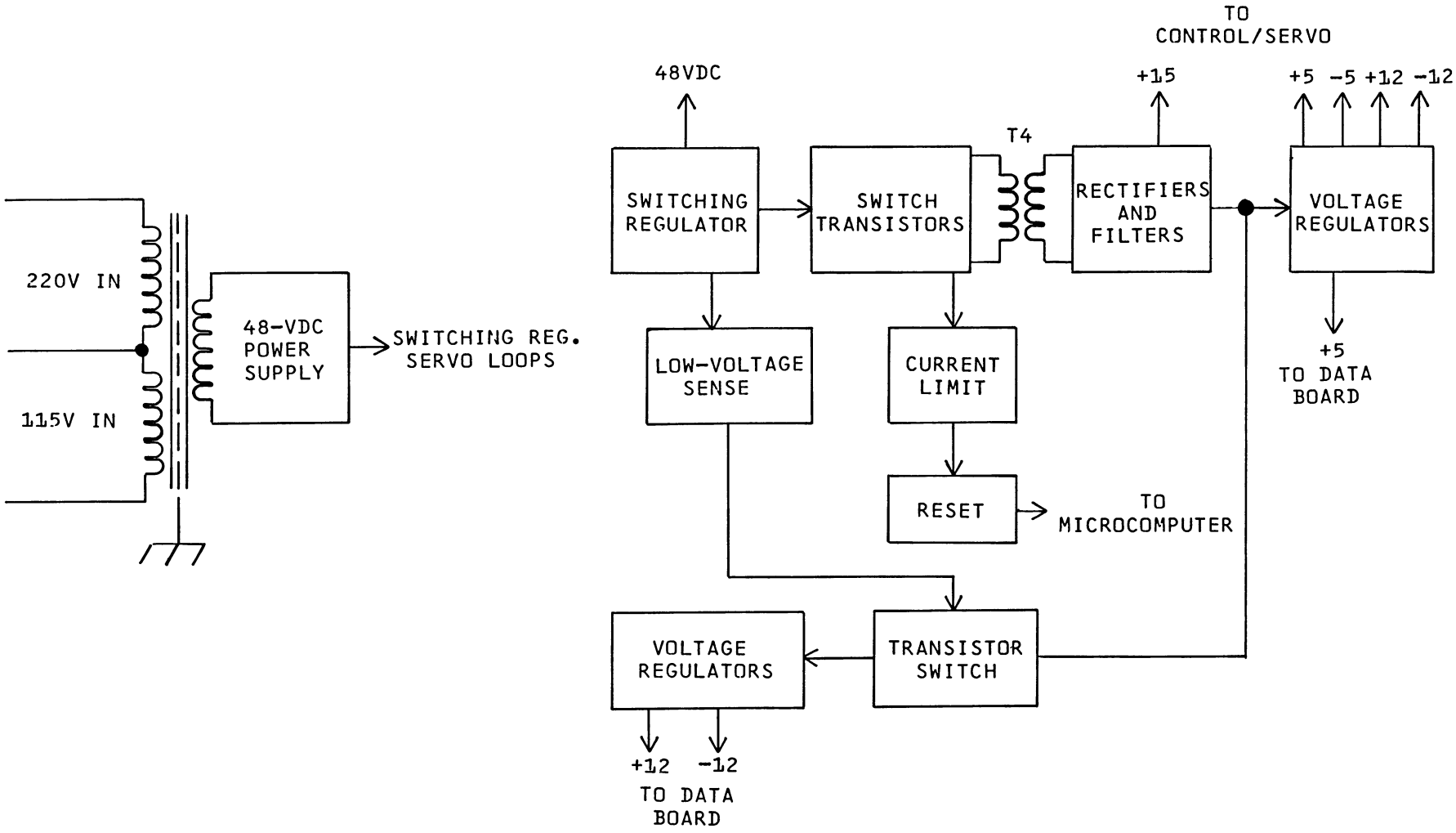


Figure 4-9. Switching Regulator, Block Diagram

-5-volt outputs are regulated by VR1 through VR5. The -5-volt output is used by the EPROMs, and the V15 RAW supply is used by the vacuum-valve control circuitry. The outputs of VR2 and VR3 supply ±12 volts to the data board. The VRAW 15 signal is switched on by control signal V14SW and is sent to the intermediate sections of the servo loops.

4-72. The reset line, $\overline{RES}$ (U96-14), is controlled by the +5-volt supply, the +48-volt V_{CC} unregulated input, and the current limit protection of the primary winding of transformer T4. To initiate a +5-volt reset condition, the charge on C166 must decrease until the low-input threshold of U96-1 is obtained. This will cause the reset line ($\overline{RES}$) to go low true. The +48-volt reset condition is sensed by comparator U95-1, which goes low when the unregulated +48-volt input is less than 30 volts.

4-73. Current Limit Protection. Zener diode CR103 (6.8V) is used to produce a reference voltage to the inverting input, U95-6. When U95-1 goes low, the low will be transferred by U95-2 as a low and then inverted twice to give $\overline{RES}$ low true. Current limit protection for the primary of transformer T4 is accomplished by R405 and U95-14. Sufficient current flow through R405 will cause U95-14 to go low, following the signal path through U95-2, U96-2, U96-4 to give $\overline{RES}$ low true. The Reset line (sheet 14) resets hex D-latches U81, U90, and U92A. It also goes to the control switch assembly, where it initially turns the LED's on during the power-up sequence. $\overline{RES}$ true resets D-latches U40, U51, U53, U58, and U69 (sheet 15).

4-74. Microprocessor-Controlled Shutdown. The Model 900X provides a microprocessor-controlled, power-failure sequence. Power supplied to the data board is shut off and is used by the control servo board to control the motion of the capstan and takeup and supply reel motors. Comparator U95-13 (sheet 1) uses the reference voltage supplied by zener diode CR103 for its inverting input, U95-10. The non-inverting input, U95-11, monitors the voltage in resistor divider network R368, R386, and R387. When U95-13 goes low true ($\overline{LOWV}$), transistor switches Q52 and Q51 open, cutting off power to the data board. $\overline{LOWV}$ is one of 32 machine status signals monitored by the microcomputer (sheet 14).

4-75. I/O STATUS INDICATION. In the case of remote commands, REWIND and ON LINE status indications are not directly controlled by the microprocessor. During the initial power-on sequence, $\overline{RES}$ is low true and resets D-latch U92 (sheet 14, Drawing No. 354012-300). After the power-on sequence is completed, the transport will be off line, and the REWIND command will be false. D-latch U92 is clocked by C7, one of eight microprocessor-controlled clocks derived from demultiplexer U91-7. The function of the latches is to speed up the presentation of the status to the formatter and/or controller.

4-76. When the D0 bit is high at C7 clock time, On-Line ($\overline{ONLS}$) will go low true. This would be the case if the ON LINE pushbutton

on the control switch assembly is pressed. Under the conditions of being selected and on line (SLTONL true), an Off-Line (OFC) input at the interface line will reset U92 to cause $\overline{ONLS}$ to go high (false). When the D1 bit is high and the C7 clock occurs simultaneously, RWDG will go low (true). This would be the case if the REWIND pushbutton on the control switch assembly is pressed. The transport will rewind when given a remote RWC if the load point indication is false and the transport is selected and on line.

4-77. The microcomputer monitors the operating status of the transport and places this information on data lines D2 through D7. At C1 clock time, hex D-latch U40 (sheet 15) transfers this information to interface connector P101 via some gating logic. The status outputs are $\overline{LDP}$, $\overline{EOT}$, $\overline{FPT}$, $\overline{DDI}$, $\overline{RDY}$, and $\overline{OPT}$. The input interface has the standard 220/330-ohm terminator networks. Inputs $\overline{ISEL}$, $\overline{IOVW}$, $\overline{ISWS}$, $\overline{ISFC}$, $\overline{ISRC}$, $\overline{IDDS}$, and $\overline{IOPTC}$ are monitored by the microcomputer. This is done by means of the four-to-one multiplexers, U44, U55, U62, and U71 (sheet 14). For any given input condition, the microprocessor will interpret and perform the operation that is commanded by the formatter and/or controller.

4-78. MICROCOMPUTER. (Figure 4-10 and Sheet 13). The microprocessor is the controlling entity in the Model 900X transport. It starts up when power is applied to the transport, addresses location 0 in memory initially, and is given an instruction. The instruction may be to jump to another location in memory, change a register, output a command, etc. There are about 500 different instructions in memory. The microprocessor obtains these instructions by way of address lines A0 through A15 and data lines D0 through D7. The instruction is fetched from memory by enabling of $\overline{M1}$ and interpretation of data lines D0 through D7. The actual data obtained by the fetch cycle will be read when $\overline{M1}$ goes false.

4-79. Memory Request (MREQ) goes true when the microprocessor (Z-80) is reading or writing from memory. Locations 0_{16} through $7FF_{16}$ in memory are set aside for the EPROMs. The RAM addresses are 2000_{16} through $20FF_{16}$. The 2708 EPROM is a 1024 x 8-bit device and is erasable by ultraviolet light. The 2111 is a 1024-bit (256 x 4) static MOSRAM with a common I/O and output disable. When I/O request ($\overline{IOREQ}$) goes true, it tells the microprocessor to read or write to the output port. The $\overline{RD}$ and $\overline{WRT}$ lines are strobed. The write command line, $\overline{WR}$, causes the microprocessor to output data on lines D0 through D7. The READ ($\overline{RD}$) command line would cause data to be input to the microprocessor on data lines D0 through D7.

4-80. EPROMs. U94 (sheet 13) is the EPROM chip select decoder. It chooses the EPROM which will be used in the execution of an instruction. Address bits A13 through A15 will be input to U93, a decoder. According to the binary number presented on its A, B, and C inputs, U93 will cause $\overline{ROM}$, $\overline{RAM}$, $\overline{OUTS}$, and $\overline{INS}$ to go true. When the $\overline{ROM}$ output is true, it will enable one input to U94, and address bits A11, A10 will complete the binary number. This will present the option of selecting either EPROM U45 or U46.

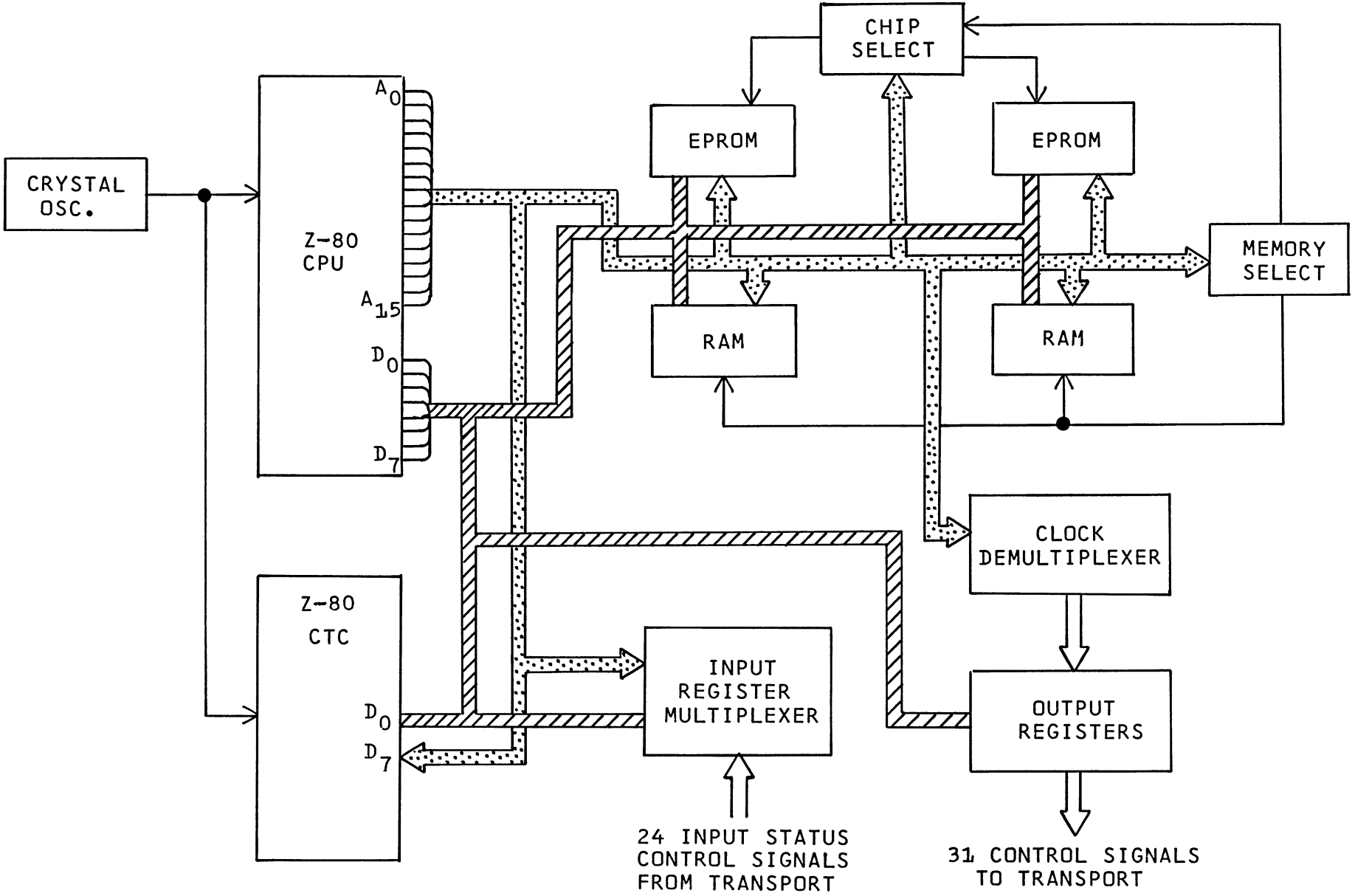


Figure 4-10. Microcomputer, Block Diagram

4-81. The EPROMs have a self-test program stored in memory. This test program will check for proper operation of the microprocessor, RAMs, and EPROMs each time the transport is powered up. During power-up, all indicators will be on for approximately 1 second. The type of failure which has been detected will initiate a unique pattern of illuminated panel indicators and can then be matched against a list of fault indications (Section VI). The purpose of the self-test program is to minimize damage to tape or machine by detecting certain fault conditions and disabling machine operation.

4-82. Crystal Oscillator (Sheet 13). The timer chip (U27) Z-80-CTC is programmed by the microprocessor to generate four clock signals. The timer is synchronized to an initial frequency by the 3.840-MHz crystal oscillator, Y1. The clock signal (I) is used by the microprocessor and the timer. ZC/TO1 is the 30-kHz clock used by the servo sections; ZC/TO0 is frequency divided by two D-latches, U78 (sheet 15), to obtain the 5-kHz frequency for the capacitive transducers, EOT/BOT sense, and phase quadrature circuits. Interrupts are controlled by the microprocessor and the CLK/TRIG0 through CLK/TRIG3 signals of the timer and program command.

4-83. MICROCOMPUTER INTERFACING (Sheets 14 and 15, Drawing No. 354012-300). The microprocessor controls the data paths for the different functions of the transport. It controls the time at which statuses are reported (e.g., EOT/BOT and the rewind sequence), the motions in the test mode, FWD and REV cycles, and the loading and unloading of the tape. While the microprocessor does not do the actual servo loop stabilization, it gates the proper circuitry to allow control of tape speed and positioning within the vacuum columns.

4-84. Microcomputer Input Registers. All of the 32 transport statuses are sensed by four-to-one multiplexers U44, U55, U62, and U71. The different inputs will give status indications of transport operation at any given time. The binary code generated by address lines A_0, A_1 will result in selection of two input signals on the multiplexer input lines. A_0 and A_1, both low, will cause 1C0 and 2C0 inputs to be transferred to the microprocessor. If A_0 and A_1 are both high, 1C3 and 2C3 are read by the microprocessor.

4-85. Since the data lines are bidirectional, there must be an address decoding scheme for selection of the proper input register at the proper time. The four multiplexer chips are enabled by the logic of AND gate U70. When A_5 goes low, the status indications are made available to the microprocessor via data lines D_0 through D_7.

4-86. Control Switch Assembly. The control switch assembly consists of two integrated circuits, LED indicators, and pushbutton switches. Input lines A0 through A2 address each switch which has a binary code identification. Code 000 corresponds to the LOAD switch and 111 to the TEST switch. The two integrated circuits decode the output indicator displays and encode the switches that are pressed. The D0 line monitors the state (on or off) of the LED

associated with the switch. C3 is pulsed low, telling the switch panel when to turn a LED indicator on or off. Reset ($\overline{RES}$) illuminates all indicators when power is first applied. Set Write Enable ($\overline{SWEN}$), when low true, reads data from the indicators. When $\overline{SWEN}$ is false, data is read from one of the switches.

4-87. Microcomputer Output Register. The output register consists of six hex D-latches, U40, U81, U90 (sheet 14), U58, U69, and U51 (sheet 15); one demultiplexer, U91 (sheet 14); and one multiplexer, U80 (sheet 15). The demultiplexer chip, U91, is used to generate the clock pulses for the six hex D-latches. The binary code set by address lines A_4, A_5, A_6 will determine the active time of clock pulses C_0 through C_7. The Q outputs of U81 and U90 are initially set low. They are clocked by C0 and C2, which are microprocessor-controlled clocks. The Q outputs are controlled by the statuses of the data bits on data lines D0 through D7. At clock time, the outputs will be set and will control different functions of the transport.

4-88. The CPSC0 and CPSC1 signals set up a binary code (Table 4-2) which controls the ramp generation circuit. There are four possible conditions:

a. No capstan motion

b. Ramps FWD

c. Ramps REV

d. Ramp generator controlled by interface command

4-89. These two lines go to U80 (sheet 15, Drawing No. 354012-300), a four-to-one multiplexer which decodes input commands CPSC0, CPSC1, and $\overline{SF}$ to give the transport the proper motion command. Basically, U80 controls FWD-REV direction commands and the selection of remote commands.

COMMAND	NO MOTION	FWD	REV	ON-LINE COMMAND
CPSC0	0	1	0	1
CPSC1	0	0	1	1

Table 4-2. Ramp Generation Binary Code

4-90. Microcomputer Output Register. $\overline{\text{REWUP}}$, REVCLAMP, and $\overline{\text{REWDN}}$ are control signals to the ramp generator circuit (sheet 2). S12 and S13 control FET switches which gate the analog circuitry of the servo section. When powered on, Enable 2, 3, and 4 go to the capstan and the supply and takeup reel servos to allow microprocessor control over them. Connector P29 goes to the blower motor, and when U90-10 goes high the motor will be enabled. V15 SW enables Q53 (sheet 1) to provide unregulated 15-volt power to the intermediate sections of the servo loops. The other three hex D-latches, U51, U58, and U69, transfer control signals to the transport circuitry. U58 outputs are S_1 through S_6, which go to the low-level sections of the capstan and takeup servos to control the FET switches. U69 outputs S_7 through S_{11} control the FET switches in the low-level sections of the supply reel servo. U69 outputs VALVE HV0 and VALVE HV1 are used by the vacuum valve control circuitry (sheet 12). Hex D-latch U51 transfers the following control signals: SSEL0 through SSEL2, which address demultiplexer U48 (sheet 12) and select the inputs to the A/D converter; VALVE 0 and VALVE 1, which control the opening and closing of the vacuum valve; and $\overline{\text{Read}}$, which is sent to the data board to control the read/write electronics.

4-91. ANALOG-TO-DIGITAL (A/D) CONVERTER (Figure 4-11 and Sheet 12, Drawing No. 354012-300). The FET switches on the left of the schematic allow the analog-to-digital converter to sample eight different inputs. The microprocessor selects the input to be sampled and the frequency of sampling. The analog signal inputs may be positive or negative. D multiplexer U48 allows the microprocessor to turn on an FET switch when the A, B, C inputs are addressed in binary form. When the inputs are 000, Y_0 will be low true and enable the ramping FET switch. When the inputs are 111, Y_7 will be low true and will enable the +XOFF FET switch.

4-92. U38 is an inverter which inputs to comparator U39-2. The signal at TP32 will indicate the polarity of the input analog signal. SNEG will be high if the input signal is negative, low if the input signal is positive. The output of comparator U39-2 also enables the FET switch when the input analog signal is positive. The FET switch allows use of common circuitry for positive and negative analog signals.

4-93. U38-12 is an absolute value summer. Its output is one-quarter of the input analog signal, except for SUERR and TUERR, for which they are one-eighth of the original input signal. This is determined by the resistors in series with FET switches U36 and U37. The output of the summer is always positive and is sent to three comparators: U39-11, U39-9, and U39-7. The inverting inputs are connected to a resistive ladder network. The comparator outputs go high if the input from the absolute value summer exceeds the voltage supplied to the inverting input by the voltage divider. Consequently, TP37 will go high if the input is greater than 0.5 volt, TP38 will go high if the input is greater than 2.0 volts, and TP39 will go high if the input exceeds 8.0 volts. These signal

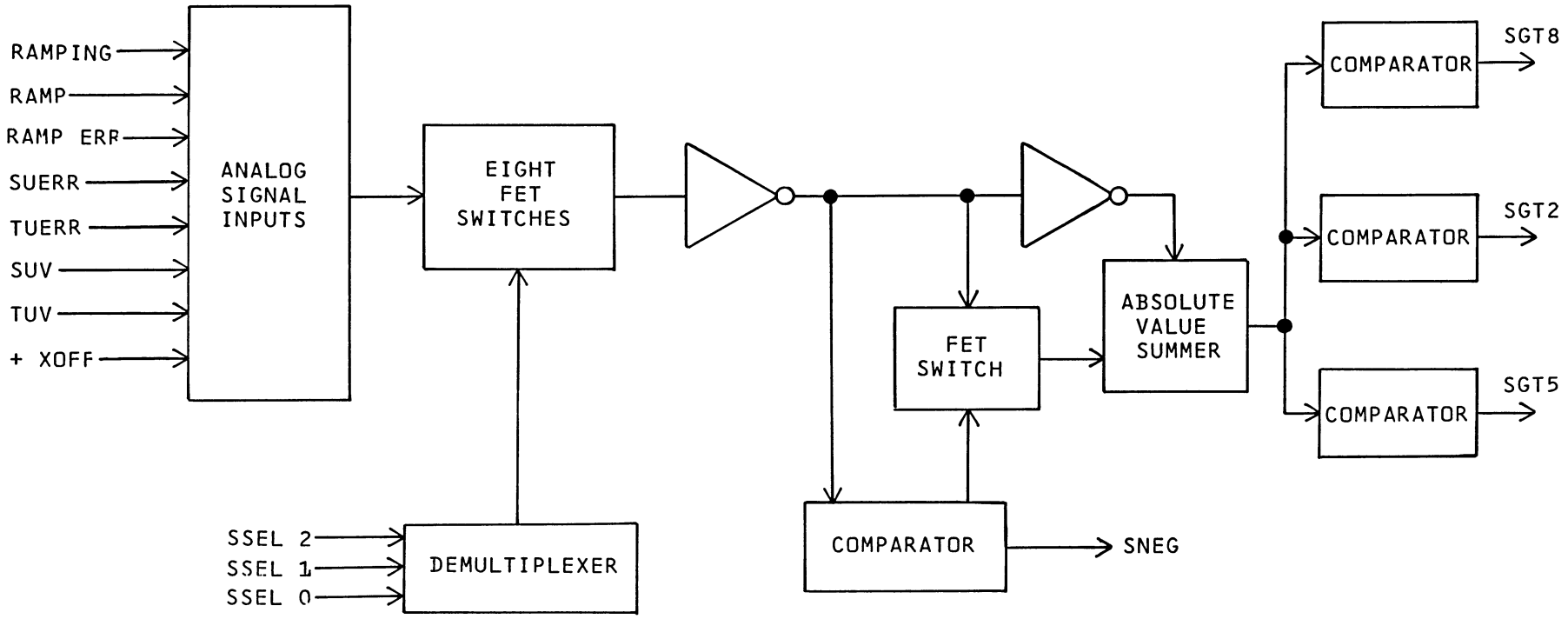


Figure 4-11. Analog-to-Digital Converter, Block Diagram

levels are sent back to the microprocessor for evaluation via four-to-one multiplexers U44 and U62.

4-94. RAMP GENERATOR (Figure 4-12 and Sheet 2, Drawing No. 354012-300). Hex D-latch U81 (sheet 14) initiates the CPSC0 and CPSC1 control signals. In turn, CPSC0 and CPSC1 address four-to-one multiplexer U80 (sheet 15). U80 issues the RNFWD and RNREV commands. In addition, $\overline{\text{RUN}}$ is sent to the data board. The RNFWD and RNREV signals are sent to the ramp generator on sheet 2.

4-95. The motion command goes through isolation diodes CR98 and CR99. Operational amplifier stages U32-4 and U32-3 buffer the signal prior to acceptance by the ramp generator. Potentiometers R244 and R243 are, respectively, the forward and reverse speed adjustments.

4-96. The ramp generator circuit is basically an operational amplifier integrator with a variable slope. U32-12, U32-10, R242, and C116 are the more important components of the circuit. The output of U32-12 (RAMPING) is one of eight signals (sheet 12) processed by the A/D converter. The nominal ramp time at 75 ips is 5 milliseconds, but, because of circuit roll off and mechanical factors, R242 is set for 4.5 milliseconds at TP27. The Ramp signal output, U76-3, is sent to the low-level section of the capstan servo loop and to the A/D converter.

4-97. The Rewind ramp circuitry centers around operational amplifier integrator U76-12. REW CLAMP is normally high true, causing Q58 to be conducting and clamp output U76-12 to ground. Two control signals, $\overline{\text{REWUP}}$ and $\overline{\text{REWDN}}$, allow a different ramp time when starting to rewind and when ramping down from rewind speed. This time differential is brought about by R340 and R341, and the ramp-down time is approximately six times faster. Diode CR101 is used for temperature isolation.

4-98. CAPSTAN SERVO, LOW-POWER SECTION (Figure 4-13 and Sheet 11, Drawing No. 354012-300). The drive to the motor is controlled by the FET switch and control signal S1. When the FET switch is off, the motor still receives current feedback coming through R247. The current feedback is of such phase as to keep the capstan motor from rotating. In this static condition, the capstan motor voltage should be approximately 0 volts.

4-99. Operational amplifier U46-4 produces the error signal obtained from summing of the tachometer feedback with the ramp input signal. The output at U46-4 indicates how much current is driving the capstan motor at any point in time, assuming S1 has enabled the FET switch. The error signal is amplified and causes the capstan motor to maintain a constant velocity. When S1 enables the FET switch in the absence of a ramp input, the motor will tend to creep because of the offset voltages developed in the servo loop. R250, the offset adjustment pot, is adjusted to cancel out the offset voltage. The loop is then stabilized and ready for normal operation.

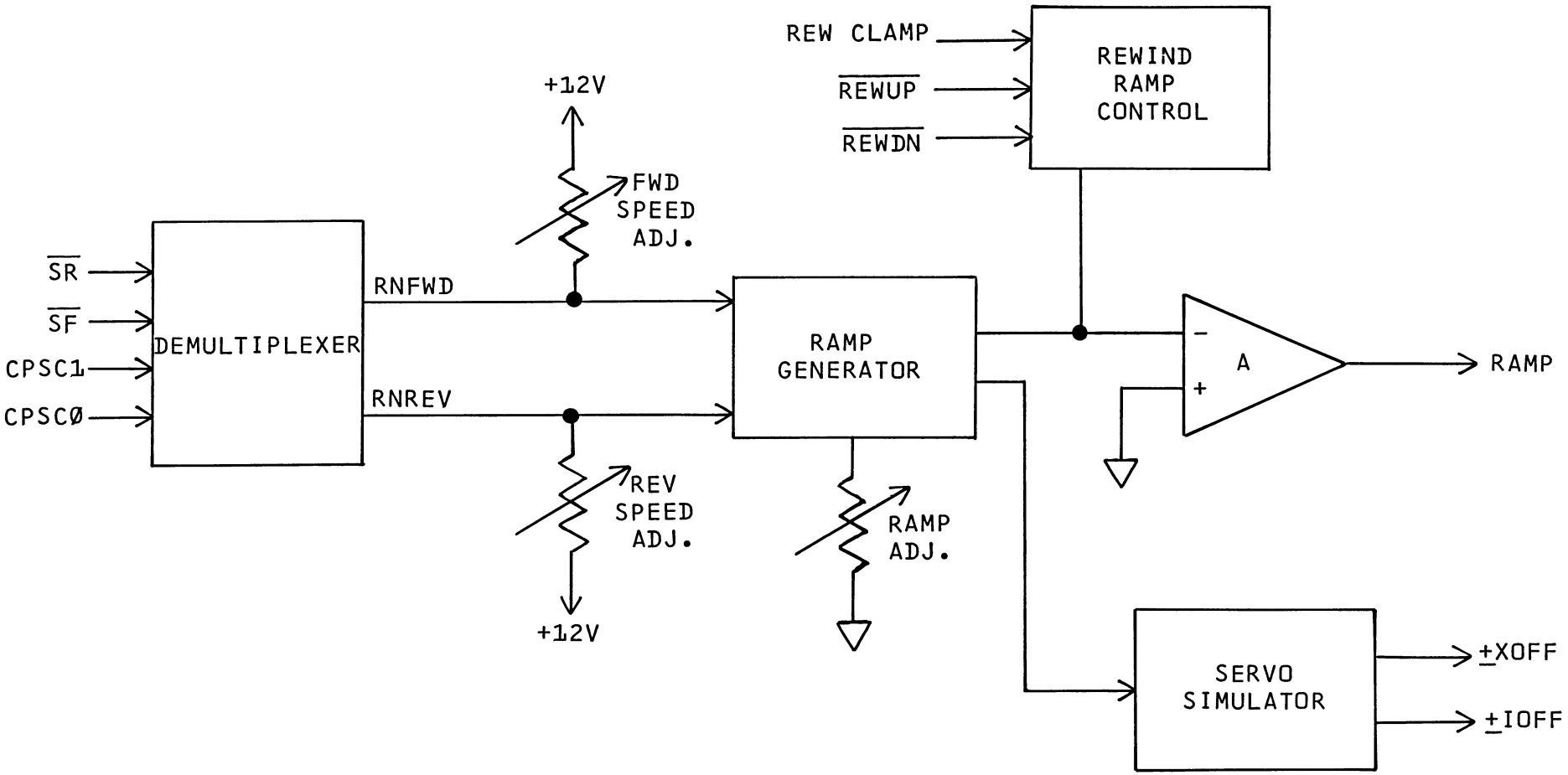


Figure 4-12. Ramp Generation, Block Diagram

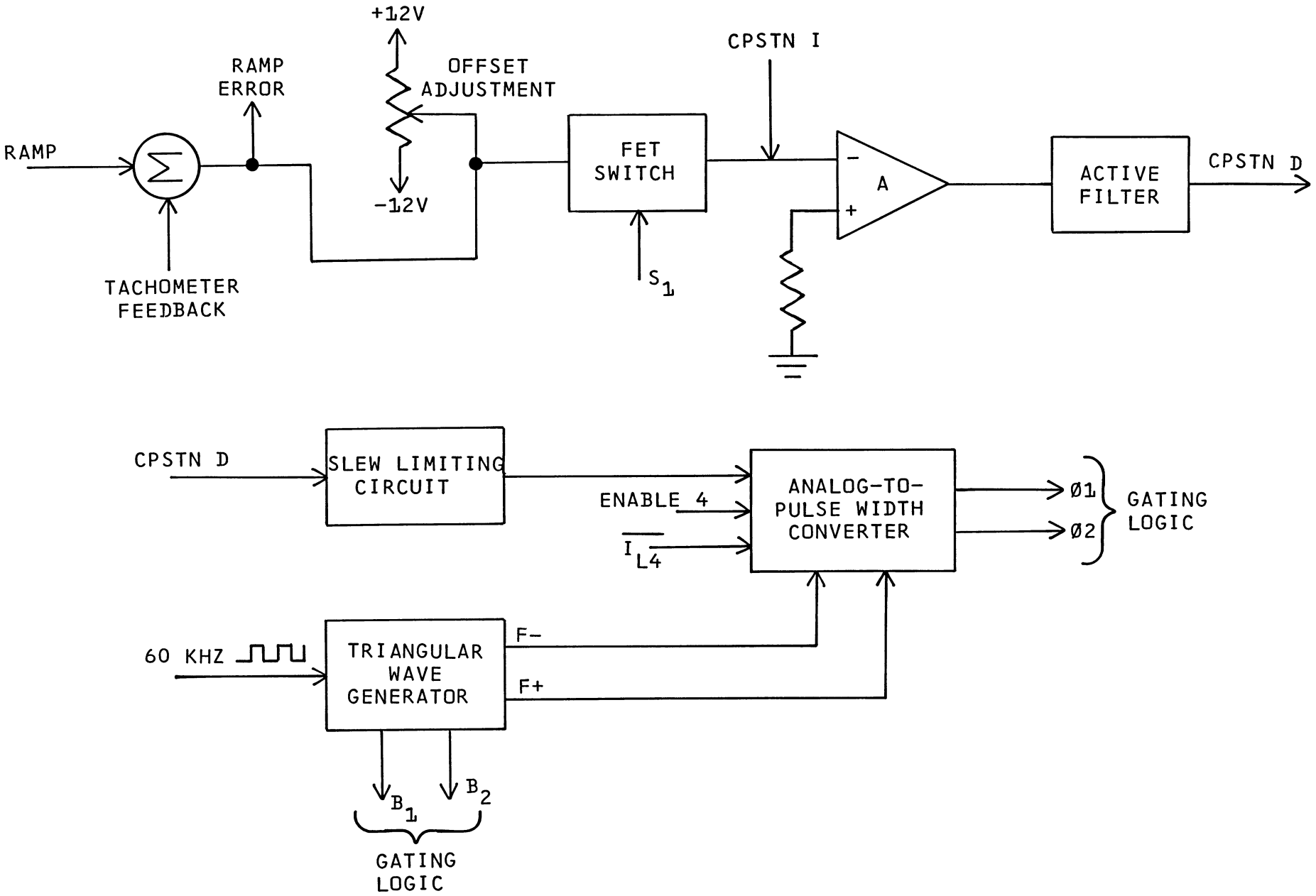


Figure 4-13. Capstan/Servo, Low-Power Section, Block Diagram

4-100. Ramp input polarity will be different for different directions of rotation. The ramp error signal at U46-4, one of eight signals processed by the A/D converter, is used by the microprocessor to control capstan motor velocity linearity during acceleration or deceleration of the motor.

4-101. The network consisting of R291, R292, R293, C127, C128, and U46-10 is a low-pass active filter with a rolloff of 3 to 4 kHz. The purpose of this filter is to eliminate any tachometer resonance problem or high-frequency ripple, introduced by the H-bridge switching network, which would come from the capstan current feedback loop. The CPSTN D signal is sent to the intermediate section of the capstan servo loop.

4-102. SUPPLY AND TAKEUP REEL SERVOS AND CAPSTAN SERVO, INTERMEDIATE SECTION (Sheets 3, 5, and 7, Drawing No. 354012-300). A clock signal (ZC/TO1) with a frequency of 60 kHz is used to clock the D-latch (U4). Its output is sent through a series of inverters and becomes B1 and B2. B1 and B2, which are 180° out of phase with each other, are used to enable one side of AND gates U8 and U10 (sheet 3). They are also used by the intermediate sections of the takeup and supply reel servo sections.

4-103. The output of U4 is also processed by a triangular wave generator, U1 and U2. The output of U1-6 is a dc bias voltage that is applied to U2-3. This bias voltage causes the triangular waveform to be symmetrical about the voltage reference. The rise-to-fall time ratio is one to one. The voltage divider consisting of R3, R4, R6, and R7 offsets the triangular waveform in plus and minus directions. This signal, f- and f+, is common to all three servo circuits.

4-104. The CPSTN D signal is brought in at U5-14, which, in conjunction with U5-3, comprises a slew-limiting circuit. Amplifiers U7-2 and U7-13 comprise an analog-to-pulse-width modulation converter. This square wave, in conjunction with B1 and B2, causes transformer drive transistors Q1 through Q8 to turn on and off. Because of the variable duty cycle, the times of conduction for these transistors may not be the same. The outputs of U7-2 and U7-13 are 180° out of phase with each other (Figure 4-14). The switching of U7 ensures that the two signals will not overlap in time; in fact, there is a 3 to 4-microsecond separation. With an equal duty cycle signal at U7, the voltage across the capstan motor will approximate 0 volts, and there should be little or no capstan motion.

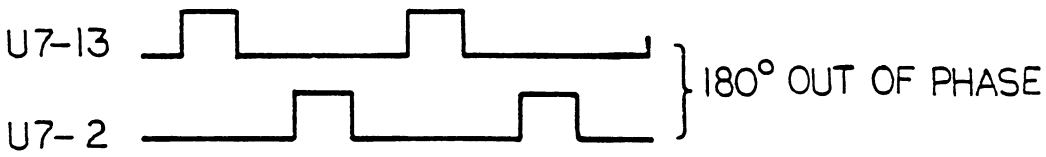


Figure 4-14. Outputs of Amplifiers U7-2 and U7-13

4-105. The transformer primary windings are driven by transistors Q1 through Q8 in a push-pull fashion. For example consider Q4 and Q1 in Figure 4-15. This produces current flow through T2-A, which turns on switching transistors Q9 and Q11 (sheet 4).

4-106. A1 (sheet 3) consists of the primary windings which turn the switching transistors of the capstan servo on or off. T4-A turns off servo transistors Q9 and Q11, and T2-A turns them on. T1-A turns on servo transistors Q10 and Q12, and T3-A turns them off.

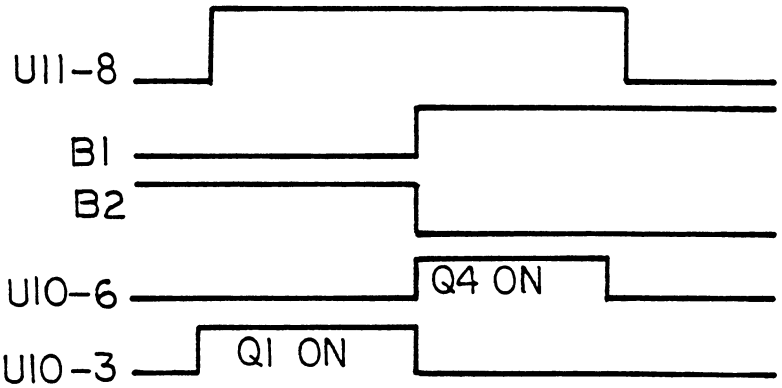


Figure 4-15. Push-Pull Operation of Transistors Q1 through Q8

4-107. CAPSTAN, TAKEUP, AND SUPPLY REEL SERVOS, HIGH-POWER SECTION. The secondaries of transformer A1 (Figure 4-16 and sheet 4) actually supply the current to the switching transistors of the H-bridge configuration. The secondary output is rectified by diodes and then drives the base of the respective transistor. The transistor is turned on for the complete pulse period of U11-8 (Figure 4-15).

4-108. The transistors are turned on and off at 30 kHz, because of the switcher configuration, and there is a large amount of current conduction through the transistors. C29 through C31 filter the glitches caused by the transformer switching. In addition, flyback diodes CR25 through CR28 protect the transistors against the inductive kick caused by the inductors and transformers. The network consisting of L1, L2, C26, and C27 comprise a filtering circuit which takes the square-wave input and transforms it into a low-frequency sine wave displaced by 25 Vdc. This minimizes RFI and protects the transistors by limiting the current used by them.

4-109. A basic description of the H-bridge operation can best be shown by referring to Figure 4-17. Q10 and Q12 are switched on together, and Q11 and Q8 are switched on together. By turning the transistors on in pairs in this way, the H-bridge circuit reverses the current driving the motor, providing a means of driving a dc motor in either direction with a single-polarity power supply.

4-110. The circuitry at the bottom of sheet 4 monitors the current of the capstan motor. C10 and C11 filter the 30-kHz switching frequency, and R54 and R55 sense the motor current. The voltage at TP2 is proportional to the capstan motor current. The other circuit

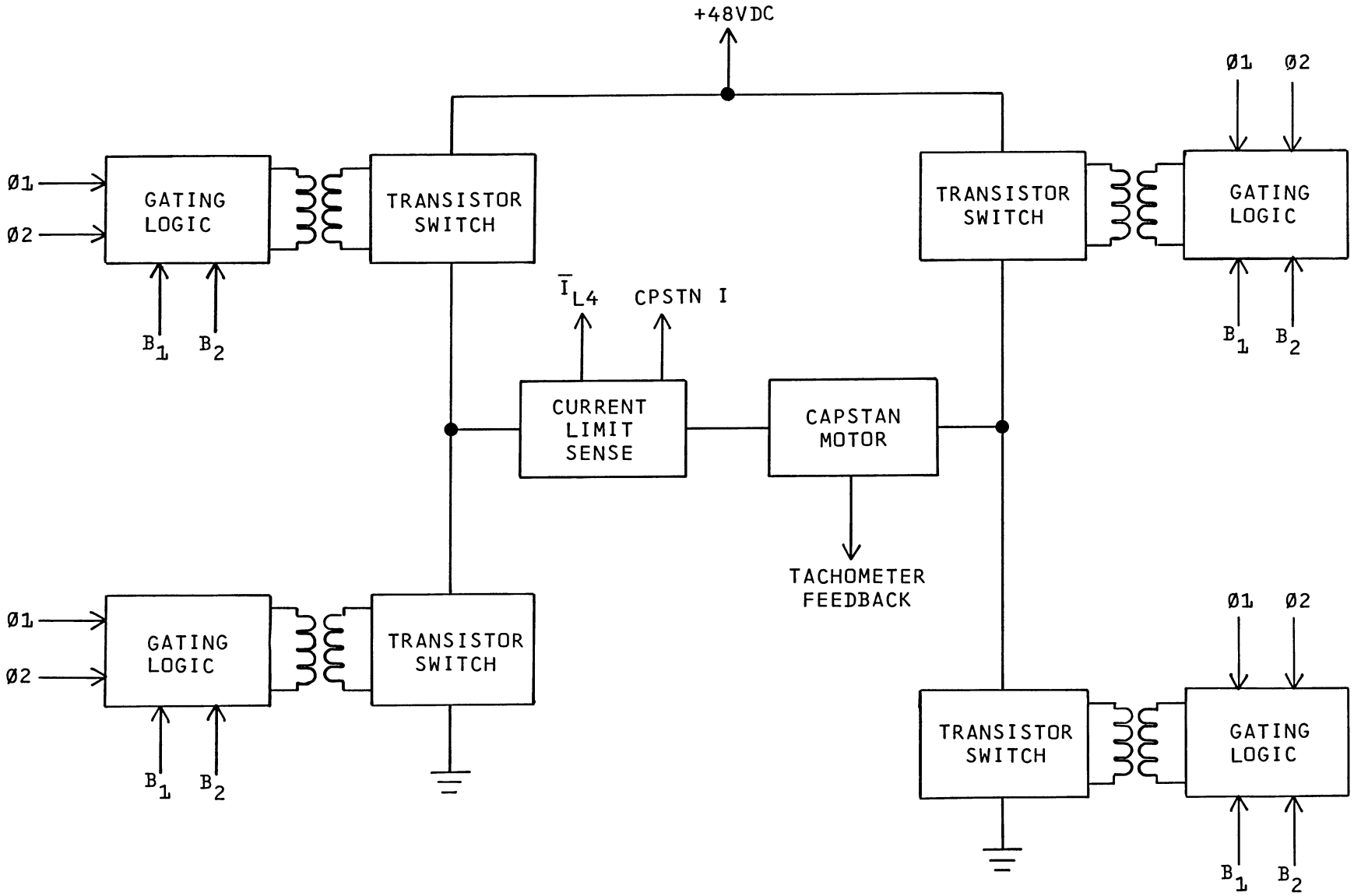


Figure 4-16. Capstan/Servo, High-Power Section, Block Diagram

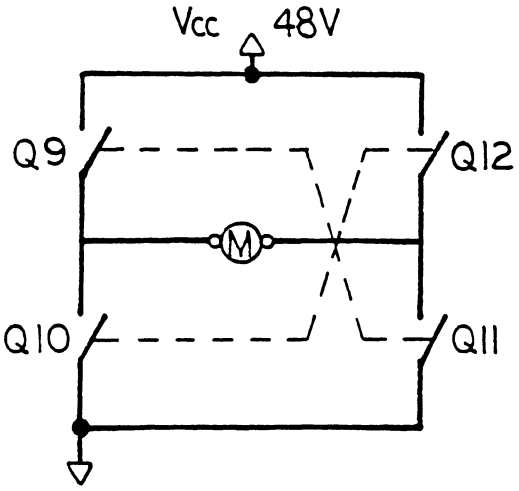


Figure 4-17. H-Bridge Operation

shown around U6 is for current-limit protection of the capstan motor. When the capstan motor is drawing too much current, $\overline{I_{L4}}$ goes low to disable the intermediate section of the capstan servo loop.

4-111. SERVO SIMULATOR. The servo simulator is representative of an ideal servo, and the transport reel servos can only approximate the servo simulator outputs (±XOFF and ±IOFF). The circuit consists of quad operational amplifier U31 and output buffer stages U30. The circuit configuration comprises an active filter with a 3-pole; 2-zero-transfer function, so the capstan ramp input signal is used to give an ideal representation of an ideal servo. The ±XOFF outputs correspond to the proper positions of the tape within the vacuum columns. The ±IOFF signals indicate the amount of current needed by the ideal servo to overcome inertia and to take up or supply more tape to the vacuum columns. These signals are sent to the low-level section of the takeup and supply reel servo circuits (sheet 11). +XOFF is sent to the A/D converter (sheet 12) also.

4-112. TRANSDUCER CONVERTER (Figure 4-18). A crystal-controlled signal (CSCHOP) is used to drive a sawtooth waveform generator, U26. The rise-to-fall time ratio is three-to-one. U26-10 applies a dc bias voltage to U26-13, causing the waveform to be symmetrical about a reference line. This waveform is sent to both capacitive transducers. The capacitive transducer can be considered a variable capacitor with a range of 100 to 500 pf, capacitance varying as the tape moves up and down in the column. These changes in capacitance produce proportional changes in input current to U26-1.

4-113. The first stages, U26-3 and U26-4, generate dc voltages in response to the changes in capacitance. The two diodes, CR96 and CR97, and the two capacitors, C79 and C100, form a half-wave rectifier which transforms the current variations to a dc voltage. The second stages, U27-7 and U27-1, compensate for the offset voltages caused by the operational amplifiers. There is also an offset adjustment which can be made for proper tape centering in the vacuum column. See paragraph 5-45.

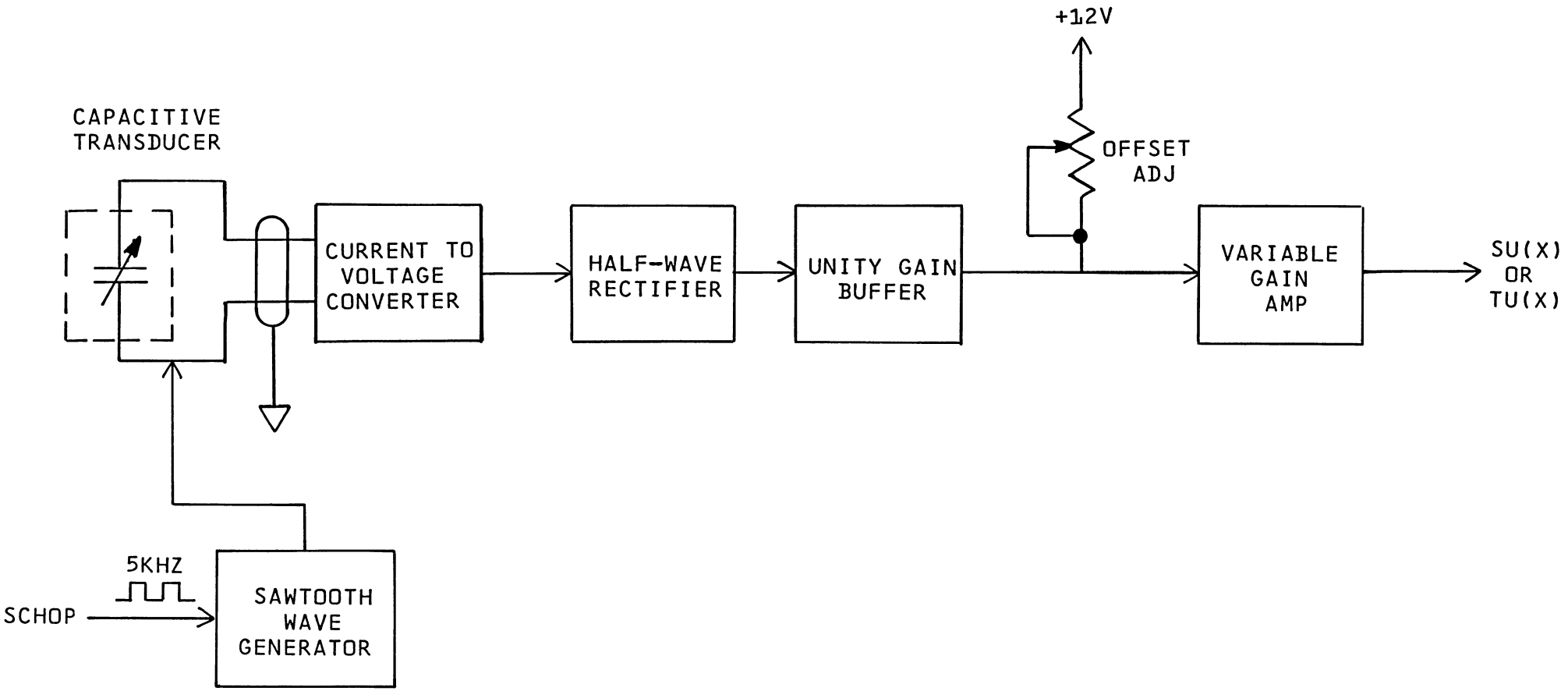


Figure 4-18. Transducer Converter, Block Diagram

4-114. The last stage, U27-14 and U27-8, is a variable-gain circuit which, for a given amount of tape movement in the vacuum columns, will produce the signals SU(X) and TU(X). These two signals are sent to the reel servo section, where they are added to the ideal servo simulator signals to produce a corrective error signal.

4-115. VACUUM VALVE CIRCUIT (Sheet 12, Drawing No. 354012-300). This circuit controls the airflow from the multistage centrifugal pump to the vacuum ports. Actuated in a fraction of a second, this control valve can shut off airflow in the vacuum columns completely, eliminating the sucking, hissing, and lapping sounds which frequently accompany unload and load sequences in more conventional vacuum-buffered tape transports.

4-116. The V15 RAW voltage is the portion of the switching power supply that is used in the operation of this circuit. Transistors Q45 and Q48 are controlled by microprocessor control signals HV0 and HV1. Their purpose is to allow leakage current to C174 and C175. Microprocessor command signals VALVE0 and VALVE1 control the closing and opening, respectively, of the vacuum port. VALVE0 and VALVE1 pulse the bases of Q46 and Q47 for approximately 100 milliseconds; the leakage current supplied to the two capacitors reduces the storage time of the transistors. Hence, the vacuum port can be opened or closed in a fraction of a second. The vacuum valve motor rotates only 90° during this operation.

4-117. The vacuum switch shown on sheet 9 is factory adjusted for 5 inches of water. TP24 goes low upon sensing vacuum in the columns. This signal, $\overline{\text{VAC}}$, is monitored by the microprocessor (sheet 14).

4-118. REEL SERVO, LOW-POWER SECTION (Figure 4-19 and Sheet 11, Drawing No. 354012-300). The description presented herein, based on the takeup reel servo system, is equally applicable to the supply reel servo.

4-119. The output of capacitive transducer TU(X) goes to U64-14. This TU(X) signal represents the tape position within the vacuum column. A full excursion would produce a ±5-volt variation, but the normal signal is ±3 volts. The TU(X) signal is summed with the -XOFF signal from the servo simulator. The -XOFF signal represents a hypothetical tape position in the vacuum column assuming the use of an ideal servo. The error signal at TP26 is a corrective factor produced by the summing of -XOFF and TU(X), which indicates the discrepancy between the actual tape position and the hypothetical position assumed for the ideal servo.

4-120. U64-12 is a differentiator, and R321, R322, and C146 comprise a high-pass filter. At the node ahead of the FET switch, -IOFF is added to the corrective error signal. The -IOFF signal is representative of the ideal servo current needed to control the reel when overcoming the effect of inertia, supplying tape, or taking up tape slack. The error signal may vary positively or negatively and will cause the transport reel motor to track the servo simulator signals.

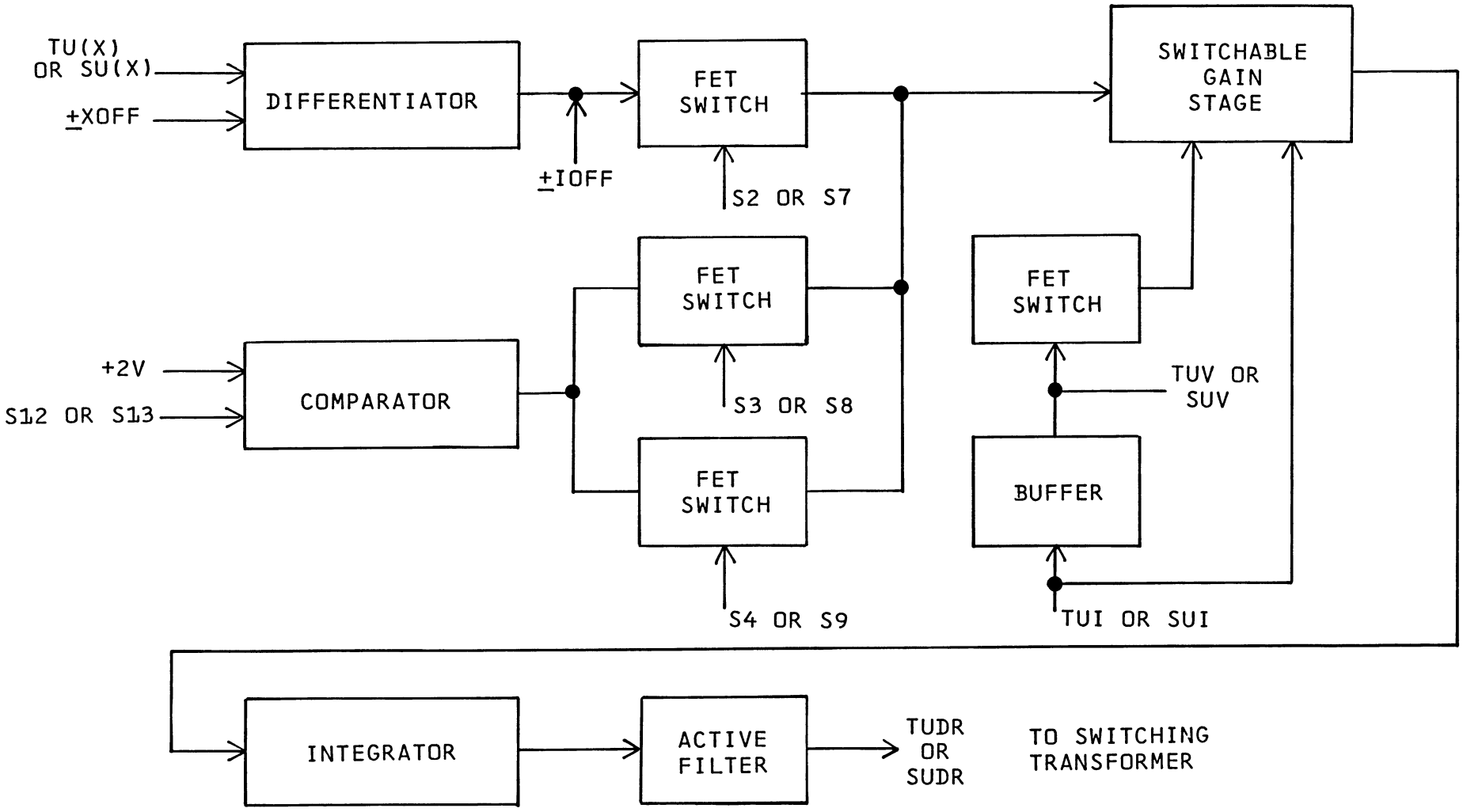


Figure 4-19. Reel Servo, Block Diagram

4-121. In normal operation, S2 and S5 enable the FET switches. S2 allows the error signal to pass, and S5 provides more gain to the signal. The amplified error signal corrects the reel motor position and the amount of torque applied to the reel of tape. In the event of a change in direction of tape motion or a variation of capstan motor velocity, the reel motors thus take corrective action to maintain a constant tape tension across the magnetic tape head.

4-122. Since the signals representing tape position in the vacuum column are not used during a load operation, S2 inhibits the FET switch during such operation. U64-4 supplies a predetermined amount of current, and control signal S12 controls the direction of rotation of the reel motor during load and unload operations. Control signal S4 allows twice the amount of current that S3 supplies. In some cases, when S3 and S4 enable the FET switches simultaneously, the current is tripled.

4-123. U64-6 is biased at approximately +2 volts, allowing control signal S12 to cause U64-4 to switch to ±11 volts. At the beginning of the load process, the tape moves forward slowly. S3 and S4 then increase the drive to the reel motors, and the tape moves faster and is drawn down into the vacuum columns.

4-124. S6 allows selection of current or voltage drive to the reel motor. With current drive, the reel motor may accelerate to high speed with little torque. Voltage drive will cause the motor to accelerate quickly to a specified velocity, which it will hold, with a greater amount of torque than in the case of the current drive. During power-failure operation, S6 will be low true, enabling the FET switch. The higher torque capability provided by voltage drive is required during power failure to control the tape reel, with its large inertia.

4-125. TUV and TUI are representative of the voltage and current being supplied to the reel motor at some point in time and are added together at the output of U65-4, whose purpose is to compensate for the resistance of the reel motor windings. TUI, the current feedback, is always an active element in the servo loop, ensuring stability of the servo loop, and TUV, voltage feedback, is used specifically during load and unload operations.

4-126. Control signal S5 is low true, enabling the FET switch and providing an alternate current path with a greater amount of current for driving subsequent stages and eventually the reel motor. The U65-12 stage translates the motor current to a voltage signal and filters the switching noise introduced by TUI.

4-127. The last stage is a low-pass, active filter. The reel motors need not be as frequency sensitive as the capstan motor, since they follow the velocity and direction of the capstan motor.

4-128. EOT, BOT, FILE PROTECT, AND POSITION SENSORS (Figure 4-20 and Sheet 10, Drawing No. 354012-300). Each of these optical/electronic sensors consists of an infrared LED and a phototransistor.

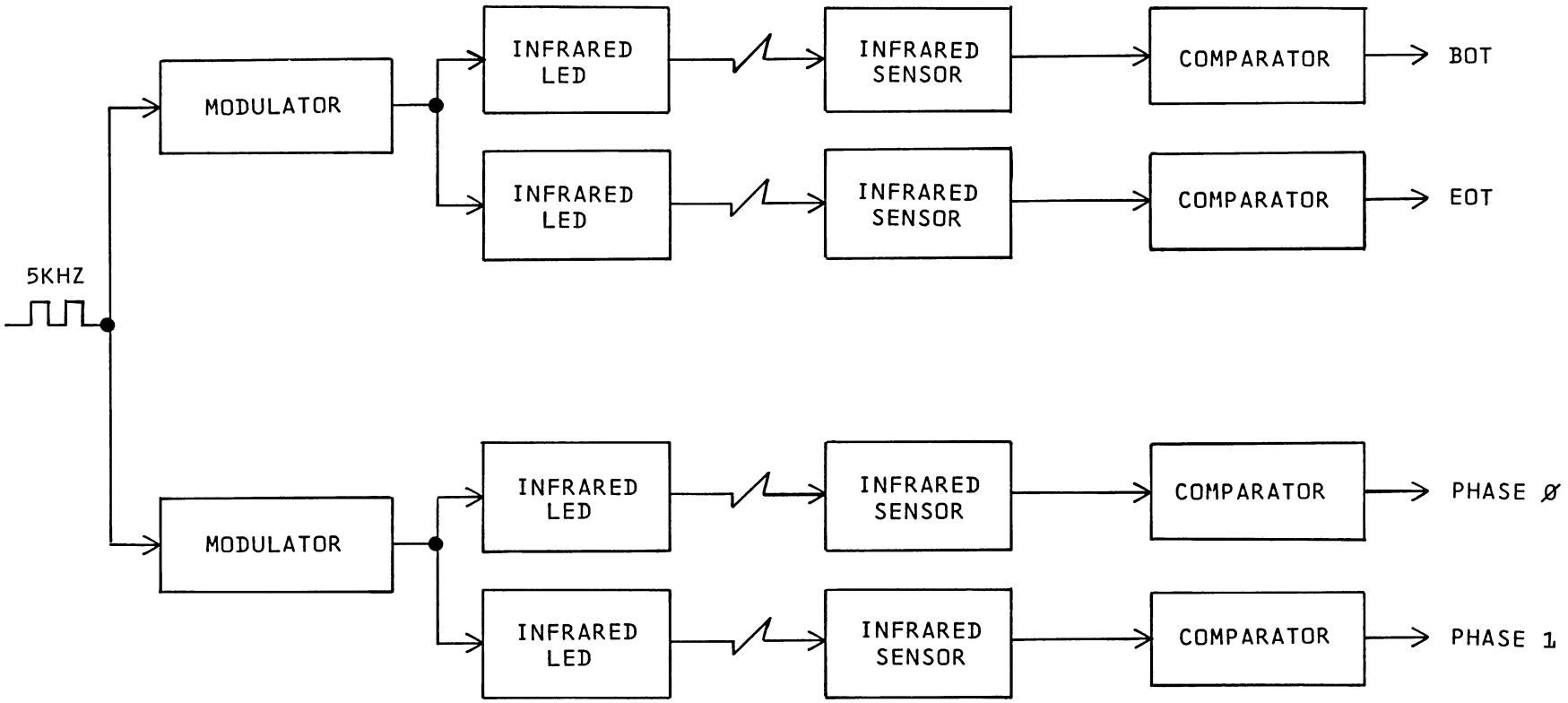


Figure 4-20. File Protect and EOT/BOT Sensors, Block Diagram

Each depends for actuation upon the positioning of a reflective tape strip in such a way as to reflect a modulated beam from its LED onto the sensing surface of its phototransistor.

4-129. EOT/BOT Sensors. The reflective strips for the EOT and BOT sensors are placed at the end and beginning, respectively, of the reel of magnetic tape. Thus these sensors provide the transport logic with the signals, used as described in previous paragraphs of this section, indicating the end and beginning of the tape with which the transport is loaded.

4-130. File Protect/Position Sensor Operation. The reflective strips for these sensors are positioned 90^{o} apart on the supply reel hub, creating two signals (phase 0 and phase 1) which are 90^{o} out of phase with each other. These signals produce a binary code which is used as data input for the phase quadrature on the supply servo. By means of this code the microprocessor can determine the direction of reel rotation, and, by counting the code iterations, the exact position of the tape within 6 inches. The tape position information is used during the rewind sequence to permit a very fast rewind (approximately 350 ips) with the ability to stop and return to load point at no risk of running out of tape leader.

4-131. When a supply reel with a file protect ring is placed on the hub, the collar on which the reflective strips are mounted is shifted in such a way as to change the phase of the binary count from what it would be with no file protect ring. Thus, by comparing the phase of the binary count with the commanded direction of tape motion, the microprocessor can determine the file-protected status of the installed reel.

4-132. Electronics. The operating current for the infrared LED's is modulated by a 5-kHz square wave. The 5-kHz frequency is derived originally from the Z-80-CTC (U72, sheet 13 of the schematic), a 20-kHz clock signal. The 20-kHz clock signal is frequency divided by a factor of four by the two D-latches, U78 (sheet 15), to provide the signal SCHOP, which is the driving signal for the LED's through transistors Q38 and Q41. As any one of the phototransistors is actuated as described above, the modulated signal passes through the corresponding capacitor (C103 – C106) to the inverting input of its section of comparator U29. The output corresponding to the actuated sensor, $\overline{\text{SEOT}}^{(L)}$, SBOT, $\overline{\text{SBOT}}^{(L)}$, Phase 1, or Phase 0, will go true.

BLANK

SECTION V

MAINTENANCE

5-1. GENERAL

5-2. This section contains periodic maintenance information, removal and replacement instructions, and adjustment procedures. Table 5-1 presents the preventive maintenance schedule. Refer to Section VII for schematic diagrams, assembly drawings, and parts lists. The tape path and locations of tape-path-related parts are shown in Figure 5-12.

CAUTION

If transport is to be swung out from equipment rack on hinges for maintenance operations, ensure that rack is mounted securely. Weight of recorder in open position could upset an inadequately mounted equipment rack.

5-3. CLEANING

5-4. CAPSTAN. For routine capstan cleaning use Freon degreaser, Type TF. (Do not use Freon flux remover.) Wipe the capstan gently, using a lint-free, nonabrasive wipe saturated with Freon. If the capstan is excessively dirty with tape oxide/binder deposits, it may be cleaned with a Q-tip slightly moistened with Inhibisol, manufactured by Amerace Corporation, Penetone Division, Tenafly, New Jersey 07670.

CAUTION

Do not clean capstan with motor running. If Inhibisol is used, do not touch capstan surface or put tape on capstan for 5 minutes after cleaning, as Inhibisol softens capstan coating temporarily. Do not use head cleaner, Freon flux remover, alcohol, or other solvents to clean capstan sleeves.

5-5. HEAD AND GUIDES. Clean the head, its associated guides, and the roller guides with a lint-free, nonabrasive wipe or a cotton swab moistened with Inhibisol.

CAUTION

Use only Inhibisol to clean head and guides. Rough or abrasive materials can scratch metal parts; other solvents, such as alcohol, can cause problems such as increased ISV. Do not soak guides with cleaner, as excess solvent may break down bearing lubricant.

5-6. TAPE CLEANER. To clean the tape cleaner, use a cotton swab moistened with Freon or Inhibisol and wipe away any accumulated debris clinging to the tape cleaner blades or housing.

MAINTENANCE OPERATION	FREQUENCY (hours)	QUANTITY TO MAINTAIN	PROCEDURE PARAGRAPH
Clean Head, Guides, Roller Guides, and Capstan	daily	—	5-4 5-5
Clean Tape Cleaner	daily	1	5-6
Check Skew, Tape Tracking and Speed	500	—	5-41 through 5-43, 5-48, 5-30 through 5-34
Check Head Wear	2,500	1	
Replace Reel Motors and Capstan Motor	10,000	3	Drawing No. 155000-999, Section VII, and paragraph 5-24

Table 5-1. Preventive Maintenance Schedule

5-7. HOUSING. The dust door and control panel may be cleaned, as necessary, with Miller-Stephenson Chemical Co. MS-260, Windex, or an equivalent commercial grade plastic cleaner.

CAUTION

Do not use rough or abrasive material to clean the plastic dust door, as permanent scrathes may result.

5-8. OPERATING VOLTAGE SELECTION

5-9. The Model 900X can be operated over a wide range of line voltages with no changing of transformer taps. Two ranges are available, 95 Vac to 135 Vac and 190 Vac to 270 Vac, simply by changing the voltage selector PWB and fuse. Both the selector PWB and fuse are located in the power cord connector housing mounted in the power supply chassis.

5-10. For the 95-Vac-to-135-Vac range, the fuse should be of a 6-ampere rating, and the voltage selector PWB should be installed so that the number 120 is the only number visible on the board. For the 190-Vac-to-270-Vac range, a 3-ampere fuse is used, and the voltage selector PWB should be installed so that the number 240 is the only number visible on the board.

CAUTION

To prevent damage to the transport and ensure proper operation, be sure the voltage selector PWB and fuse are proper for the power source to be used before applying power to the transport.

5-11. POWER SUPPLY CHECKS AND ADJUSTMENTS

5-12. UNREGULATED VOLTAGE CHECKS. Check unregulated voltages on the power regulation portion of the control/servo PWB. Required values and tolerances are presented in Table 5-2.

NOTE

In checking voltages, ensure that input line voltage is set to the correct value (paragraph 5-9).

VOLTAGE TERMINAL	RETURN TERMINAL	REQUIRED READING
J14-4	J14-2	+48(±15%)V
TP54	TP42-49 (all grounds)	$+15(^{+2.0}_{-1.0})$V

Table 5-2. Power Supply Unregulated Voltages

5-13. REGULATED POWER SUPPLY ADJUSTMENTS. The potentiometer used for this adjustment is located on the power regulator portion of the control/servo PWB. Test point locations are shown in Figure 5-1. Referring to Table 5-3, for each of the power supplies listed measure voltage across the test points shown.

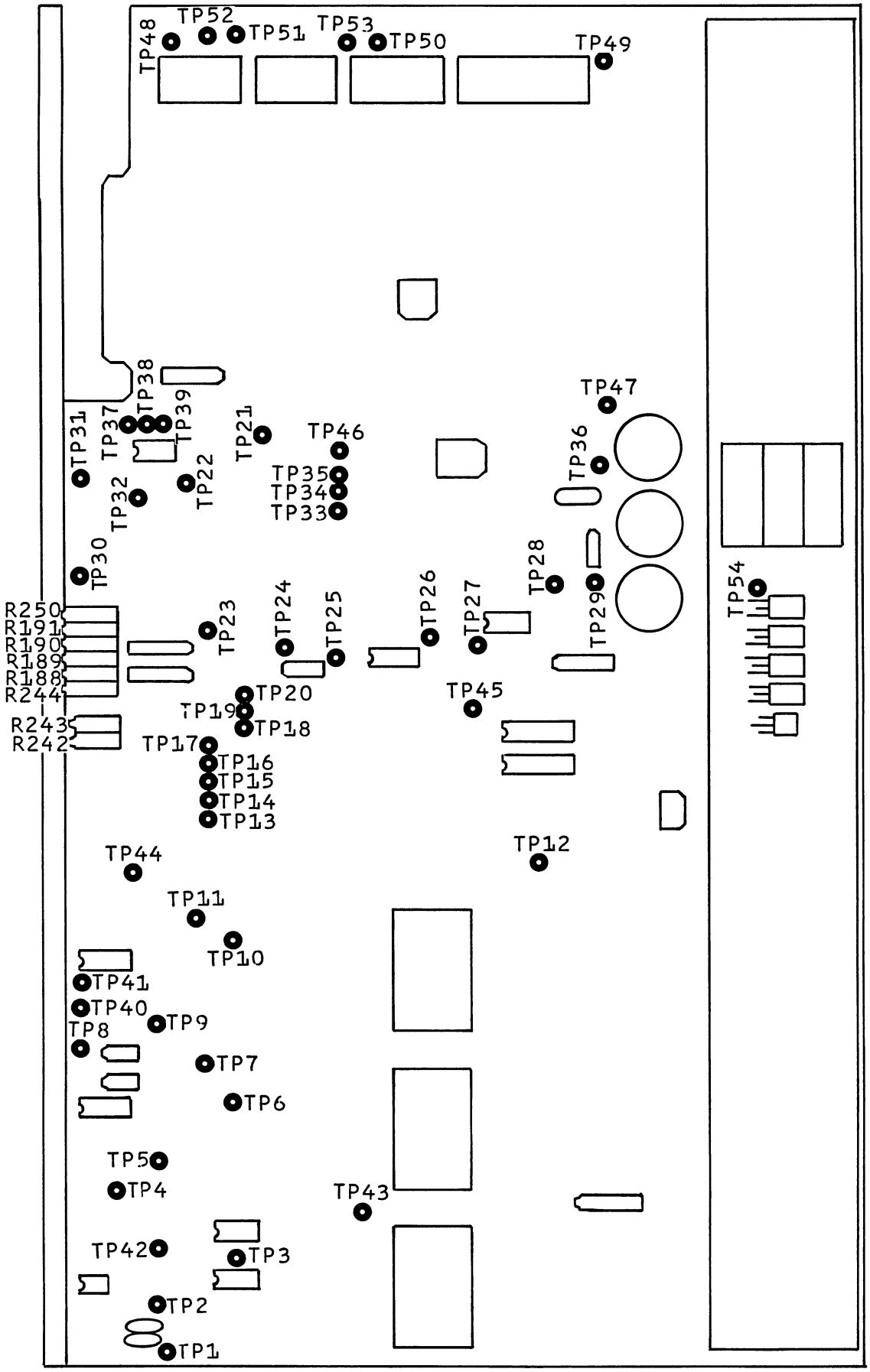


Figure 5-1. Control/Servo PWB Test Point Chart

SUPPLY	TEST POINT	RETURN TEST POINT	ADJUSTMENT POT	REQUIRED READING
+5V	TP50	TP42 - 49	R367	+5(±0.05)V
+12V	TP52	TP42 - 49	—	+12(±0.5)V
-12V	TP53	TP42 - 49	—	-12(±0.5)V
-5V	TP51	TP42 - 49	—	-5(±0.25)V
+12V	J7-9	TP42 - 49	—	+12(±0.5)V
-12V	J7-6	TP42 - 49	—	-12(±0.5)V

Table 5-3. Power Supply Regulated Voltages

5-14. REMOVAL, REPLACEMENT, AND MECHANICAL ADJUSTMENTS

5-15. Cipher transports are designed to operate for long periods of time without requiring adjustment. In the event a mechanical adjustment is required, it is recommended that the unit be returned to the Cipher factory for that purpose. Procedures for removal and replacement of damaged or defective mechanical parts, together with any needed adjustments following replacement, are discussed in the following subparagraphs.

5-16. PUSHBUTTON/INDICATOR REPLACEMENT. The pushbuttons are extremely long-life, momentary-contact devices, and the indicators are LED's. Both the pushbuttons and LED's are soldered directly into a PWB. Consequently, field repair is impractical, and the complete PWB should be replaced in the event of malfunction. However, individual components are available to facilitate service center repair of the PWB. Replace the PWB as follows:

a. Remove power cord from back of tape transport.

b. Remove brushed aluminum facade from front of switch housing by pulling loose adhesive that holds facade. Discard facade.

c. From back of top plate, remove four screws holding switch housing.

d. Remove four screws securing switch PWB to switch housing. Unplug switch harness connector from control/servo PWB, feed cable and connector through hole in top plate casting, and withdraw switch PWB assembly.

e. Install replacement switch PWB assembly in reverse order of removal.

f. Install new brushed aluminum facade. Center openings for pushbutton switches carefully to avoid rubbing or binding.

5-17. SINGLE-EDGE TAPE GUIDE. To replace a damaged or worn single-edge tape guide (Figure 5-2) or one of its parts, proceed as follows:

a. Loosen three press-lock fasteners and open bottom vacuum column door.

b. Remove mounting screw from base plate and disassemble tape guide parts as required.

c. Replace defective part, reassemble parts in accordance with Figure 5-2, and secure to base plate with mounting screw. No adjustment is required. Be sure guide mounting surface is free of burrs and debris which could keep guide from seating solidly on machined casting surface. Note that sapphire washer has only one polished surface, which must be surface against which tape rides.

WARNING

Before performing any maintenance procedure requiring access to interior of recorder, disconnect power cord to eliminate possibility of severe electric shock.

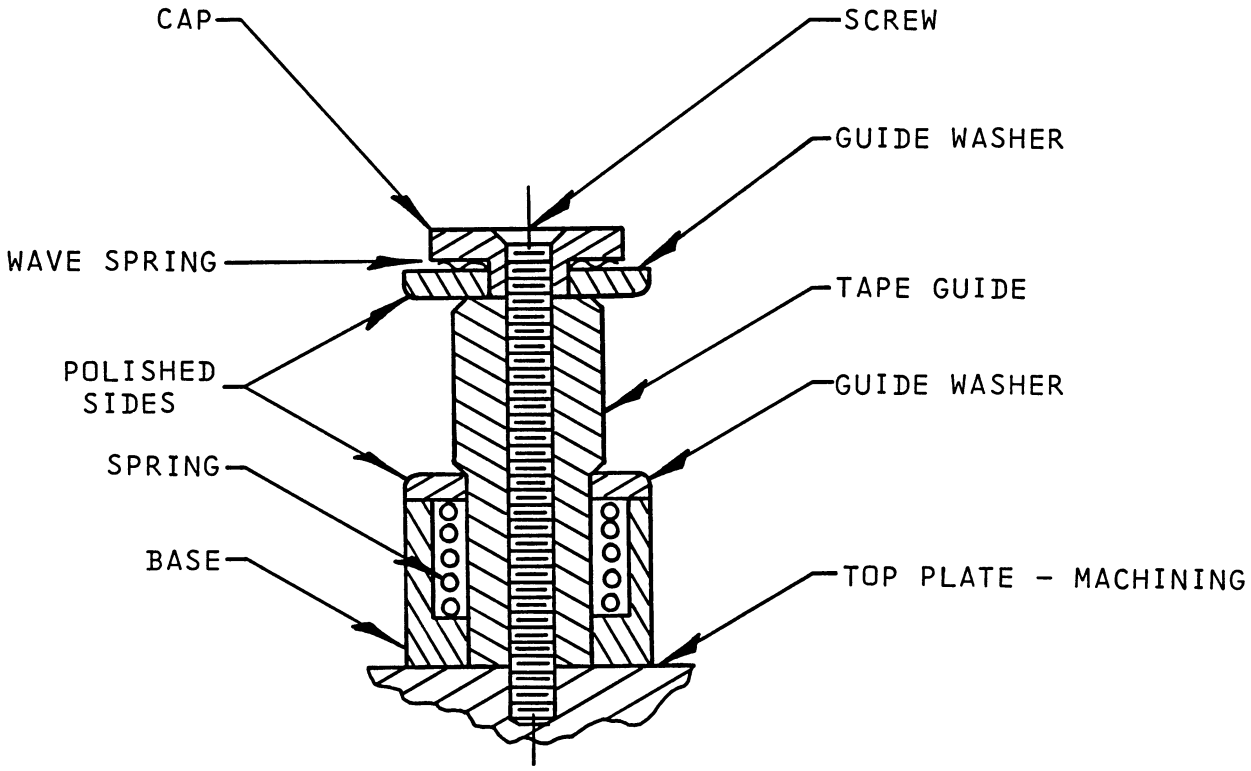


Figure 5-2. Single-Edge Tape Guide

5-18. ROLLER TAPE GUIDE REPLACEMENT. The roller tape guide should never require replacement during the life of the tape transport. However, if it becomes necessary to replace a damaged or defective roller guide, the complete assembly must be changed as a unit. Proceed as follows:

a. Loosen three press-lock fasteners and open side vacuum column door.

b. Remove screw securing defective roller guide. Carefully withdraw roller guide, taking care not to drop any small parts or springs.

c. Using new screw provided with replacement roller guide assembly (discard nut and washer), secure roller guide in position. Take care that the springs are properly positioned, as shown in Figure 5-3, before tightening screw.

d. No adjustments are required.

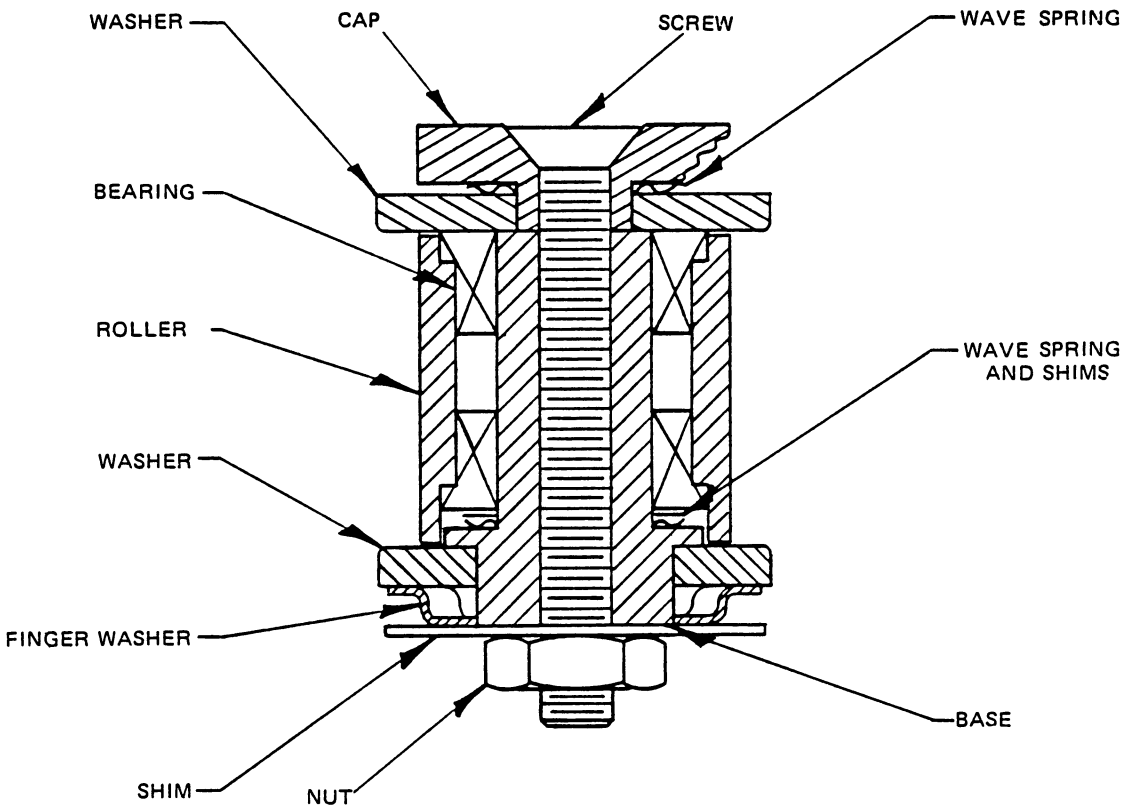


Figure 5-3. Roller Tape Guide

5-19. TAPE SENSOR. The complete EOT/BOT sensor assembly is built and tested as a single unit and must be replaced as such. Removal and replacement procedures are as follows:

a. Unplug electrical connector from control/servo PWB.

b. Remove four screws securing head cover to head cover standoffs.

c. Remove three screws securing sensor brackets and cable clamp to front of base plate.

d. Pulling wires and connector carefully through hole provided, remove sensor from base plate.

e. Install replacement sensor in reverse order of removal, being careful to mount sensor at correct distance from tape. Face of sensor elements should be 0.150 inch from tape.

f. No electrical adjustments are required.

5-20. REEL-HUB GRIP RING. Removal and replacement procedures for the reel-hub grip ring are as follows:

a. Lift reel lock lever to unclamp grip ring.

b. Pull old grip ring out of hub groove and remove.

c. Install new grip ring by stretching over reel hub into proper position.

CAUTION

Clean grip ring with Freon degreaser, Type TF only. Alcohol, head cleaner, and other solvents will damage grip ring.

5-21. REEL HUB. Replace and adjust the supply or takeup reel hub as follows (Figure 5-4):

NOTE

Before removing, replacing, and/or adjusting takeup reel, remove attaching screws of surface plate and face plate and lift off plates.

a. Loosen socket-head screws and remove hub.

b. Install replacement hub on shaft to obtain dimension shown in Figure 5-4, and tighten socket-head screws.

c. Mount reel of tape on transport, thread tape, and place recorder in load mode.

d. Run tape forward and reverse, noting tape position on reel for which replacement hub was installed. If necessary, readjust hub height to center tape on reel.

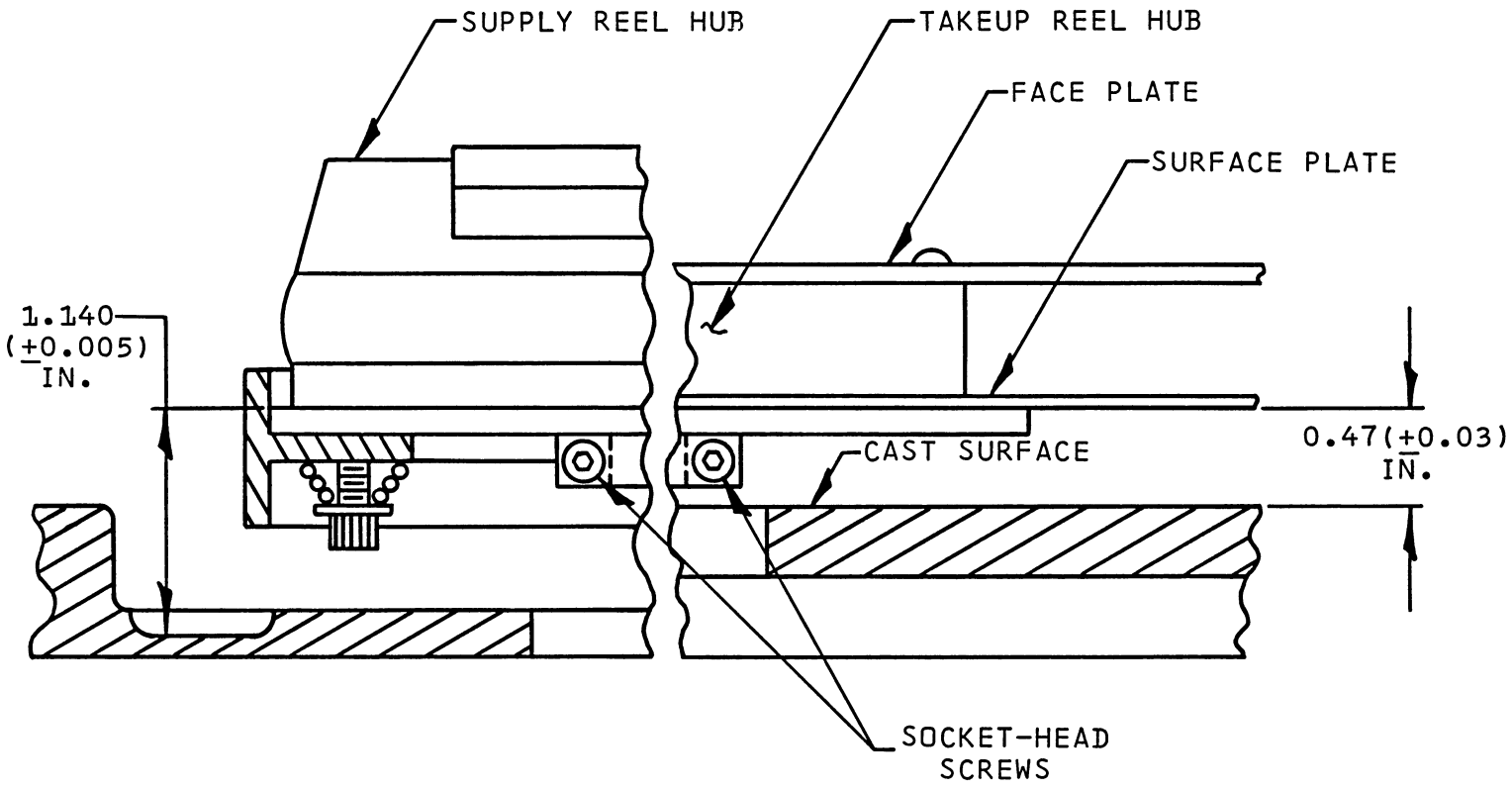


Figure 5-4. Reel Hub, Showing Adjustment Dimension

e. Using right-angle Allen wrench capable of applying 30 inch-pounds of torque, tighten socket-head screws securing hub as tightly as possible.

5-22. HEAD ASSEMBLY. Remove and replace the head assembly in accordance with the following procedure:

NOTE

Hard-faced heads are very sensitive to tape wrap angle. After installing new head, lapping tape may be required for optimum head performance. Lapping tape and complete instructions may be obtained from Cipher by ordering Lapping Tape Kit P/N 154036-101.

a. Remove four screws securing head cover to head cover standoffs.

b. Loosen three press-lock fasteners and open bottom vacuum column door.

c. Unplug head electrical connectors from read/write PWB.

d. Remove four screws securing head assembly to base plate (Figure 5-5).

NOTE

One of four mounting screws is small screw inside azimuth screw.

e. Withdraw head assembly, carefully feeding wires and connectors through hole in base plate.

f. Feed wires and connectors of replacement head assembly carefully through hole, and secure head assembly to base plate with three socket-head screws not used for azimuth adjustment. Thread outer azimuth adjustment screw into head assembly mount (Figure 5-5), and thread inner azimuth adjustment screw loosely into it.

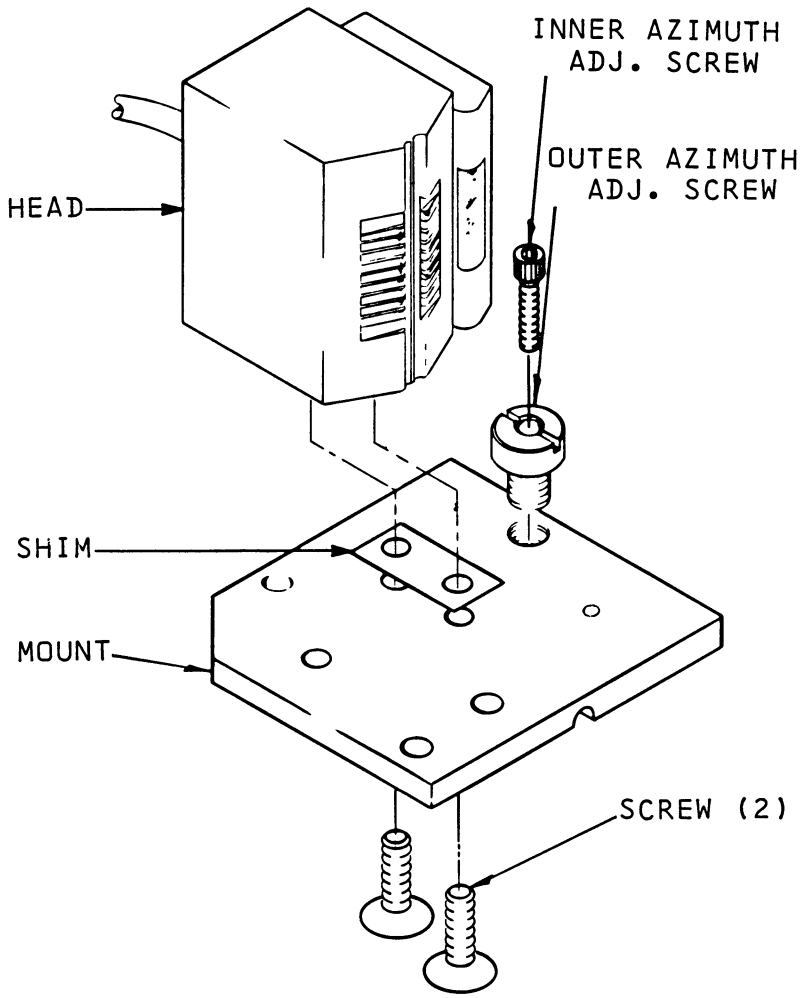


Figure 5-5. Head Assembly Adjustments

g. Make skew adjustment in accordance with paragraphs 5-41 through 5-43.

5-23. CAPSTAN. To replace a damaged or defective capstan, proceed as follows:

a. Screw 1-inch-long, 10-32 NF screw into end of capstan hub until it contacts end of motor shaft. Hold capstan with 1/4-inch open-end wrench (see Figure 5-6), and tighten screw. This will cause capstan sleeve to be pulled from motor shaft.

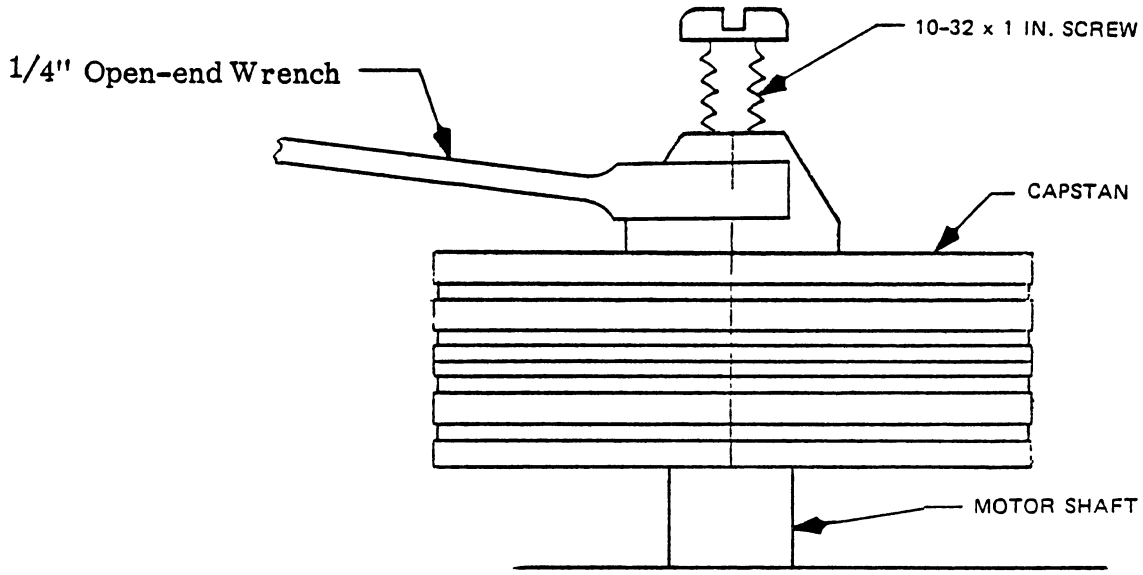


Figure 5-6. Capstan Removal

b. Install replacement capstan over motor shaft until resistance is felt. Insert 1/2-inch-long, 6-32 NC screw through hole in capstan hub, and screw it into threaded hole in motor shaft. Tighten screw until head of screw comes in contact with front of capstan to be pulled onto motor shaft. Tighten screw until capstan is centered evenly in vacuum column opening (see Figure 5-7).

CAUTION

Avoid contact with sensitive tape-driving surface of capstan sleeve. Damage to this surface will cause erratic performance and render capstan sleeve useless.

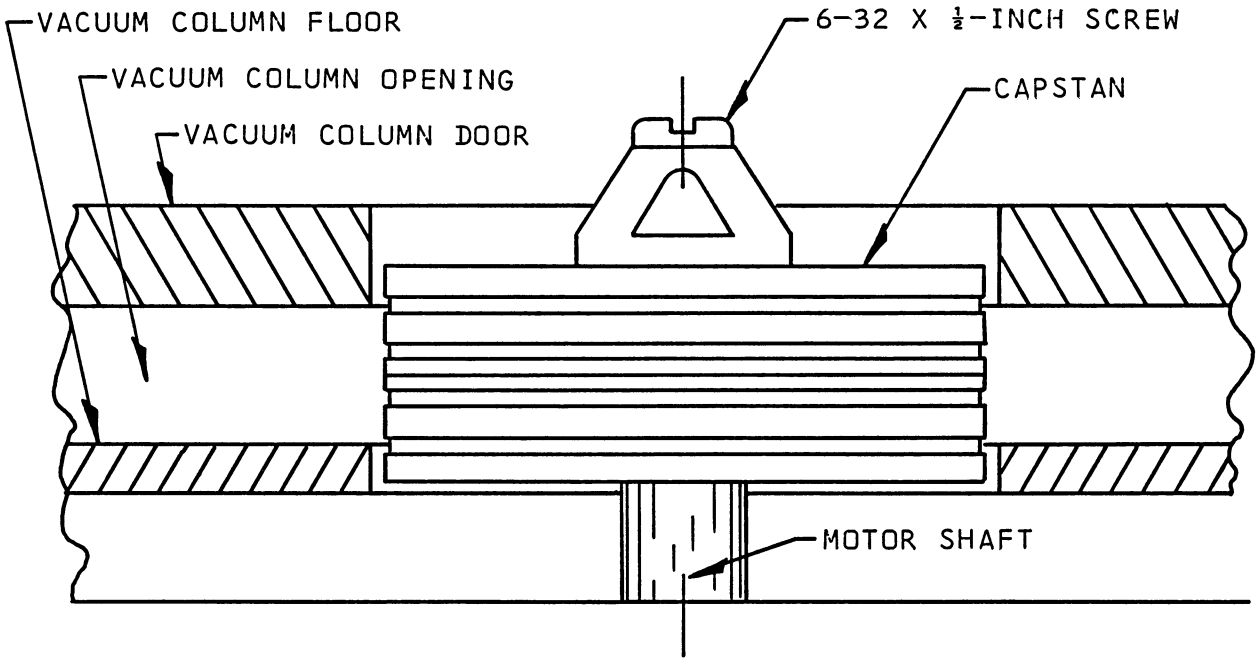


Figure 5-7. Replacement Capstan Positioning

c. Mount reel of tape on transport, thread tape, and place in load mode. Check overall capstan performance and adjust if necessary in accordance with paragraph 5-48, steps g through i.

5-24. CAPSTAN MOTOR ASSEMBLY. To remove and replace the capstan motor assembly, proceed as follows:

a. Disconnect power cord from tape transport.

b. Remove capstan sleeve from capstan motor shaft as specified in paragraph 5-23.

c. Unplug capstan motor and tachometer connectors from control/servo PWB.

d. Remove three screws and motor clamps securing capstan motor to back of machine. Withdraw motor.

e. Install replacement capstan motor assembly in reverse order of removal.

f. Adjust capstan sleeve height and capstan motor tilt as specified in paragraph 5-23 and paragraph 5-48, steps g through i. Adjust capstan motor speeds, ramp times, and offset as specified in paragraphs 5-30 through 5-35.

5-25. VACUUM VALVE MOTOR ASSEMBLY. Remove and replace the vacuum valve motor assembly as follows:

a. Disconnect power cord from transport.

b. Remove right-side vacuum column floor assembly following procedure presented in paragraph 5-55.

c. Unplug valve motor connector from control/servo PWB. Remove contacts from connector housing using Molex Tool No. HT-2038.

d. Loosen two setscrews securing valve cord to motor shaft.

e. Remove screws, washers, and lockwashers that mount valve motor assembly and withdraw motor assembly. Feed motor cable through grommet, taking care not to damage grommet with sharp contacts.

f. Replace valve motor assembly in reverse order of removal. When tightening setscrew make sure valve rotor does not bind or drag against valve housing or housing mounting screw. Note that motor mounting bracket has slotted holes for adjustment.

5-26. VACUUM BLOWER. Remove and replace the vacuum blower as follows:

a. Disconnect power cord from transport.

b. Remove cover from blower mounting bracket.

c. Disconnect vacuum blower wires from terminal block and capacitor. Note colors and positions of wires.

d. Remove screws, washers, and lockwashers securing vacuum blower to mounting bracket. Support blower securely to prevent it from falling when mounting screws are removed. Install replacement blower in reverse sequence of removal. Be sure to compress rubber/foam gasket between vacuum blower face and top plate to ensure airtight seal.

5-27. VACUUM VALVE ASSEMBLY. Remove and replace the vacuum valve assembly as follows:

a. Remove vacuum blower as specified in paragraph 5-26.

b. Remove vacuum column floor/transducer assembly as specified in paragraph 5-55.

c. Loosen two setscrews securing valve cord to valve motor shaft.

d. Remove two screws, washers, and lockwashers securing valve housing to top plate casting, and remove valve assembly.

NOTE

Ensure that valve pin does not slide out of housing. If valve is to be reused, protect it carefully from damage that might cause binding. Clean parts thoroughly before reassembly, using Inhibisol.

e. Clean RTV sealant off mating surface of top plate.

f. Install new vacuum valve in reverse sequence of above steps.

CAUTION

To avoid damage and ensure proper operation of transport, when mounting valve housing to top plate ensure that mating surfaces are free of burrs and other foreign material and that housing is held tightly against top plate surfaces as screws are tightened. Insert valve pin into housing fully before attaching housing to top plate to keep mounting screws from damaging valve rotor.

When attaching valve cord to valve motor shaft, position rotor so it does not touch housing mounting screw and so that stop pin does not drag on housing as valve rotates. Tighten setscrew securely and recheck for binding and drag.

g. When valve assembly is installed and functions without bind or drag, seal with RTV. See Section VII, Top Assembly Drawing No. 155000-999, sheet 4, "Vacuum Valve Installation."

5-28. VACUUM SENSE SWITCH ASSEMBLY. Remove and replace the vacuum sense switch assembly as follows:

a. Unplug power cord from tape transport.

b. Unplug vacuum sense switch connector from control/ servo PWB.

c. Remove screws, washers, and lockwashers securing switch assembly to top plate casting, and withdraw switch. Clean RTV sealant off mating surface of top plate casting.

d. Apply small bead of RTV around nozzle of new switch assembly, and replace switch in reverse order of removal procedure.

5-29. POWER SUPPLY ASSEMBLY. Remove and replace the power supply assembly as follows:

a. Unplug power cord.

b. Remove four screws and lockwashers securing cover to power supply chassis, and withdraw cover.

c. Remove four screws and lockwashers securing cover to vacuum blower mounting bracket, and withdraw cover.

c. Pull Fast-On terminals off power switch lugs. (Wires are number coded.)

e. Remove power supply leads from terminal block and Optoisolator located on vacuum blower mounting bracket. (Wires are number coded.)

f. Unplug power supply connector from control/servo PWB.

g. Remove screws and lockwashers securing power supply to top plate casting, and withdraw power supply.

h. Install replacement power supply in reverse sequence of above steps.

i. Before applying power, verify that voltage selector PWB and correct fuse are properly installed with reference to power source voltage. (See paragraph 5-8.)

j. Check power supply voltages in accordance with paragraph 5-11.

5-30. CAPSTAN SERVO ADJUSTMENTS

5-31. DC OFFSET ADJUSTMENT. Connect a digital voltmeter to pins 1 and 2 of connector P8, and adjust potentiometer R250, on the control/servo PWB (Figure 5-1), for 0(±0.05) Vdc.

5-32. COARSE SPEED ADJUSTMENT. Make a coarse adjustment of speed in accordance with the following procedure:

a. Monitor tachometer output voltage at TP12, located on capstan servo portion of control/servo board. (See Figure 5-1 for location of test points.)

b. With transport in off-line mode (ON LINE indicator not illuminated), depress FWD pushbutton.

c. Adjust forward potentiometer R244 until voltage at TP12 is approximately +2.5 Vdc at a speed of 125 ips.

d. Depress FWD pushbutton to stop tape motion, then depress REV pushbutton.

e. Adjust reverse potentiometer R243 until voltage at TP12 is approximately -2.5 Vdc for a speed of 125 ips.

f. Depress REV pushbutton to stop tape motion.

5-33. FINE ADJUSTMENT PROCEDURE. If desired, a speed adjustment with an accuracy of 2% can be obtained with the use of the strobe disc (Figure 5-8) mounted on the capstan. (If not included on the transport, order Cipher Part No. 755005-401.) With the transport in off-line mode, depress the FWD pushbutton. Adjust forward potentiometer R244 until the strobe disc appears to be motionless (outside lines for 60 Hz, inside lines for 50 Hz). To adjust reverse speed, use the same procedure, but depress the REV pushbutton and adjust using reverse potentiometer R243.

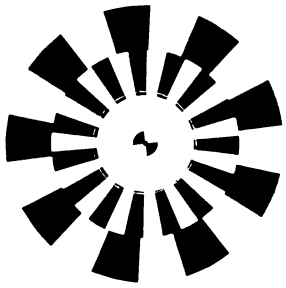


Figure 5-8. Strobe Disc

5-34. ALTERNATE FORWARD AND REVERSE FINE SPEED ADJUSTMENTS. Measure and make a fine adjustment of tape speed as follows:

a. Load known-density master skew tape on transport. Connect counter to TP10 on dual-mode data board (Figure 5-9).

b. With transport in off-line mode (ON LINE indicator not illuminated) depress FWD pushbutton and adjust counter to trigger on negative-going edge of data pulse.

c. Adjust forward speed control potentiometer R244 on capstan servo portion of control/servo board to obtain appropriate data rate of 100K (at 800 bpi, 125 ips).

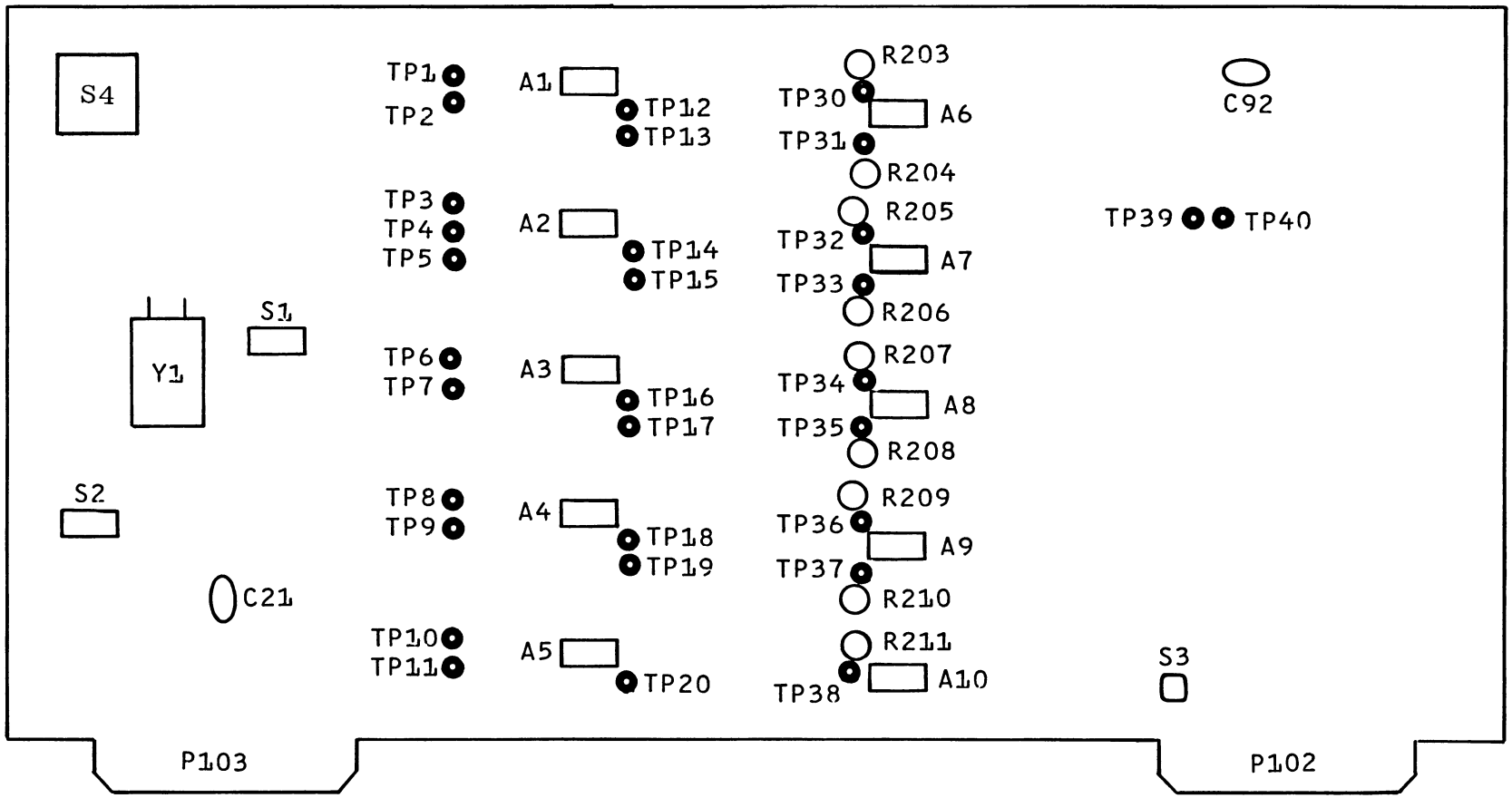


Figure 5-9. Dual-Mode PWB Test Points, Pots, Headers, and Switches

d.. Depress FWD pushbutton to stop tape motion.

e. Depress REV pushbutton.

f. Adjust reverse speed control potentiometer R243 to obtain appropriate data rate in step c.

g. Depress REV pushbutton to stop tape motion.

h. Readjust ramp time in accordance with paragraph 5-35.

5-35. RAMP ADJUSTMENT. This adjustment is to be made while starting and stopping the tape motion and observing the ramp in both forward and reverse modes. This can be done with the transport on line while writing blocks of data or off line by using the autocycle test mode (paragraph 6-5).

a. Use oscilloscope to monitor ramp tachometer test point TP27 on control/servo board with respect to ground.

b. Trigger oscilloscope with run command at U-89 pin 2.

c. Adjust ramp potentiometer R242 to obtain ramp time of 3 ms at 125 ips. (See Figure 5-10.)

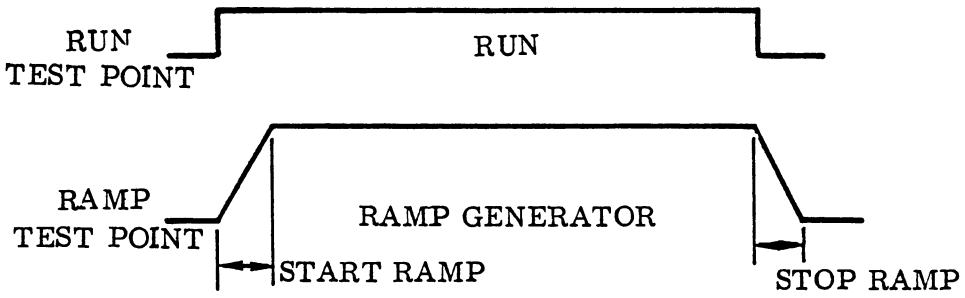


Figure 5-10. Ramp Adjustment Traces

5-36. DATA PWB INITIAL SWITCH SETTINGS

5-37. Refer to Tables 5-4 and 5-5 for all switch settings and functions.

5-38. Before making adjustments on the data PWB, set the switches initially to the following positions:

a. Switch 1, positions 1 and 2: both closed.

b. Switch 1, positions 3 and 4: see Table 5-4 for position versus transport tape speed.

TAPE SPEED (ips)	CRYSTAL FREQUENCY (MHz)	SWITCH 1	
		Position 3	Position 4
12.5	1.280	Open	Open
18.75	1.920	Open	Closed
25.0	1.280	Closed	Open
37.5	3.840	Open	Closed
45.0	4.608	Open	Closed
75.0	3.840	Closed	Open
90	4.608	Closed	Open
125	6.400	Closed	Open

Table 5-4. Tape Speed Crystal Frequencies and Switch 1 Settings

c. Switch 1, positions 5 through 8: all open.

d. Switch 2, positions 1 through 3: all open.

e. Switch 2, position 4: closed.

f. Switch 2, position 5: open.

g. Switch 2, positions 6 and 7: see Table 5-5.

h. Switch 3, position 1: open.

i. Switch 3, positions 2 through 4: see Table 5-5.

CAUTION

With pushbutton SW4, closed, all tapes will be write enabled. Ensure that this switch is open when test tape or other recorded tape is on transport to prevent erasure.

NOTE

Switch 3, positions 3 and 4, must be closed for Model 900X.

SWITCH	POSITION		FUNCTION
1	1	2	
	Open	Open	Skew Gate = 12%
	Open	Closed	Skew Gate = 25%
	Closed	Open	Skew Gate = 37%
	Closed	Closed	Skew Gate = 50%
	3	4	
	Closed	Open	Running Freq. = Crystal Frequency
	Open	Closed	Running Freq. = 1/2 Crystal Frequency
	5 Closed		Provides PE (3200 fci) write clock in test mode
	6 Closed		Provides NRZI (800 fci) write clock in test mode
	7 Closed		To view skew at TP10 in skew test
	8 Closed		Selects high-speed status
2	1 Closed		Enables transport select in test mode
	2 Closed		Enables 800 fci in test mode
	3 Closed		Enables 1600 fci in test mode
	4	5	
	Open	Open	Low threshold detect
	Closed	Open	Normal threshold detect
	Closed	Closed	High threshold detect
	6	7	
	Open	Open	Low Density
	Open	Closed	Control servo density select
	Closed	Closed	High Density

Table 5-5. Switch Settings for Testing and Options

SWITCH	POSITION	FUNCTION
3	1 Closed	Enables write reset (WRT, P20-2) on control/servo or control power PWB
	2 Closed	Enables higher write current (with head P/N 799010-601 only)
	3 and 4 Open	Not used for Model 900X.
	3 and 4 Closed	For use with Model 900X only.
4	Closed	Write PE or NRZI in test mode, all tapes write enabled, file protect inoperative.

Table 5-5. Switch Settings for Testing and Options (Continued)

5-39. READ GAIN ADJUSTMENTS

5-40. NRZI. Adjust NRZI read gain as follows:

a. Change switch settings as follows:

(1) Switch 1, position 6: closed.

(2) Pushbutton SW-4: closed.

(3) Switch 2, position 1: closed.

(4) Switch 2, position 2: closed.

NOTE

Switch settings, on the data board for test mode, override the front panel HI DEN indicator.

b. Start writing all-1's record by depressing FWD push-button (indicator illuminated).

c. Referring to Figure 5-9, connect oscilloscope to TP30 and ground.

d. Adjust gain potentiometer R203 to obtain 8-volt reading (peak-to-peak) on oscilloscope. This adjusts gain for Channel P.

e. Repeat for Channels 0 through 7, using TP31 through TP-38 and R204 through R211, respectively.

5-41. NRZI WRITE SKEW VERIFICATION. Check NRZI write skew as follows:

a. Close position 7 of switch 1.

b. Connect oscilloscope to TP10.

c. Proper waveform is shown in Figure 5-11.

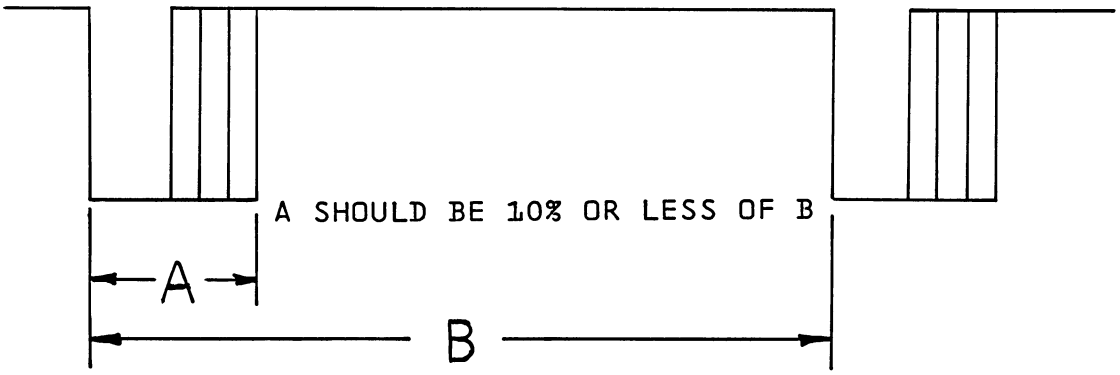


Figure 5-11. Skew Pulse at TP10

5-42. PHASE-ENCODE SKEW VERIFICATION. Check PE read levels as follows:

a. Make the following changes in switch positions:

(1) Switch 1, position 5: closed.

(2) Switch 1, position 6: open.

(3) Switch 1, position 7: open.

(4) Switch 2, position 2: open.

(5) Switch 2, position 3: closed.

b. Switch settings, on the data board for test mode, override the front panel HI DEN indicator.

c. Start writing all-1's tape by actuating FWD pushbutton/ indicator (indicator illuminated).

d. Verify 4-volt reading (peak-to-peak) at TP30 through TP38.

5-43. HEAD AZIMUTH ADJUSTMENT. Adjust read skew as follows:

a. Return all switches to initial settings (paragraph 5-38).

b. Close switch 1, position 7, and switch 2, positions 1 and 2.

c. Load and tension 800-bpi master skew tape.

d. Connect oscilloscope to TP10 on data board (Figure 5-9) and ground.

e. With transport in off-line, low-density mode (ON LINE and HI DEN indicators extinguished), depress FORWARD pushbutton.

f. Adjust azimuth screws (Figure 5-5) on head mounting plate so that outputs of all tracks, as monitored at TP10, fall within 10% or less of byte-to-byte period in forward direction, and 12% in reverse direction. (See Figure 5-11.) Outer azimuth screw bears against transport mounting plate and pivots head assembly outward. Inner azimuth screw threads into transport mounting plate and pulls head assembly inward. Inner screw also serves to lock adjustment.

5-44. Return PWB to normal operating mode by setting all switch positions in accordance with paragraph 5-38.

5-45. CAPACITIVE TRANSDUCER ALIGNMENT

5-46. This alignment procedure requires the use of the diagnostic test procedure described in Section VI, paragraphs 6-6 through 6-15. Align the capacitive transducers as follows:

a. Observe marks on facade at following points: on takeup column, at 1-, 6¼-, and 11½-inch distances from right edge of glass; on supply column, at 2-, 7¼-, and 12½-inch distances from top edge of glass.

NOTE

Diagnostic test programs 4 through 7 are used in this alignment procedure, and the diagnostic test procedure must be sequenced through test programs 1 through 3 to access 4. See paragraphs 6-6 through 6-15.

b. Using diagnostic test program 4, load a full 10½" reel of 1.5 mil tape approximately 10 ft past BOT marker.

c. Increment test diagnostic to test program 5 by pressing LOAD pushbutton once. LOAD and REWIND indicators will illuminate.

NOTE

Restrain takeup and supply reels by hand or masking tape to prevent excessive tape from entering vacuum column. Position tape loop at center of each column.

d. Adjust zero-adjustment potentiometers R189 (supply servo) and R188 (takeup servo) on control/servo PWB (Figure 5-1) until REV and TEST lamps, respectively, change state (illuminate if previously extinguished or vice versa). Adjustments are correct at these points.

e. Press LOAD pushbutton to increment test diagnostic to test program 6 (REWIND and ON LINE indicators illuminated). This test is used to adjust supply and takeup servo gains for forward tape motion.

f. Move tape to mark at bottom of supply transducer column and to mark at right-hand side of takeup transducer column. Adjust potentiometer R190 for supply servo gain and R191 for takeup gain until TEST and REV lamps change state. Note positions of potentiometers.

g. Press LOAD pushbutton to increment test diagnostic to test program 7 (LOAD, ON LINE, and REWIND indicators illuminated). This program is used to set gain adjustment potentiometers for reverse tape motion.

h. Move tape to top mark in supply transducer column and to left-hand mark in takeup transducer column. Adjust potentiometers as in step g, noting positions of potentiometers.

i. Readjust gain potentiometers to positions halfway between those noted in steps f and h.

j. Check adjustments by loading a full 10½" reel of tape until an approximately equal mass of tape is obtained on both reels. Stop the tape motion and trim the offset for both the supply and take-up null points.

5-47. MECHANICAL ADJUSTMENTS

5-48. TAPE PATH ALIGNMENT. Referring to Figure 5-12, align the tape path in accordance with the following procedure:

a. Remove facade, head cover, and EOT/BOT cover.

b. Adjust takeup and supply reel hubs to proper heights, as shown in Figure 5-4.

c. Mount reel of tape, thread transport, and load tape. Before running tape, adjust EOT/BOT reflector parallel to and approximately 1/32-inch from tape. Adjust EOT/BOT sensor 0.150-inch from tape.

d. Run tape forward and reverse, and adjust reel hub height as required to center tape on reels.

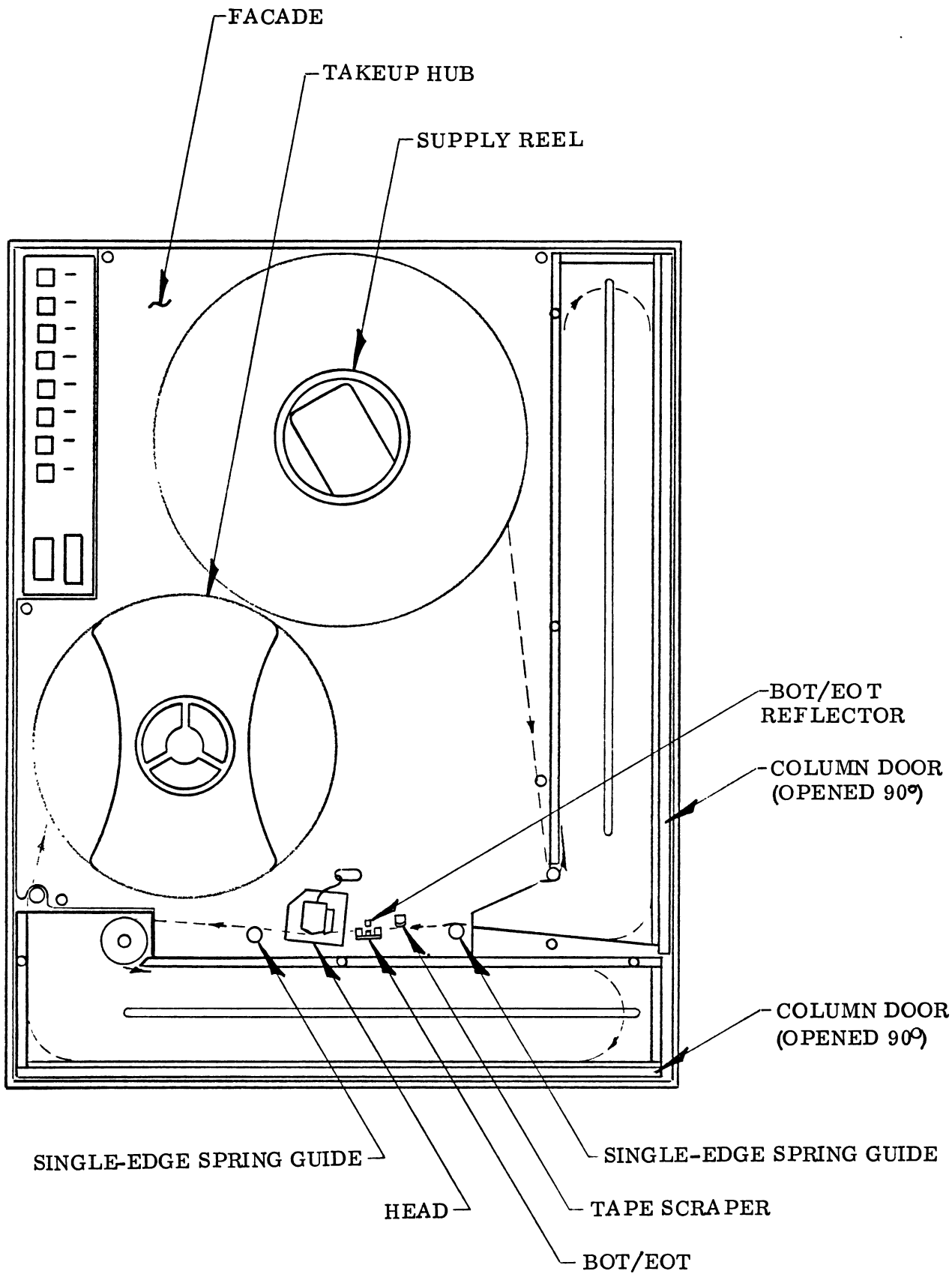


Figure 5-12. Tape Path Alignment

e. Run tape forward for approximately half of reel. Run tape in reverse, and observe position of tape on capstan sleeve.

f. Stop tape and adjust height of capstan sleeve in accordance with paragraph 5-23 so that tape is centered on sleeve when running in reverse direction.

g. Run tape alternately forward and reverse, and observe tape position on capstan sleeve. Tape position should not shift when direction of tape travel is changed.

h. If tape shift is observed, capstan motor tilt must be adjusted. If tape moves away from top plate when running forward, capstan sleeve must be tilted away from head and guides. To tilt sleeve slightly, loosen mounting screw farthest from head and guides, and install mylar shim(s) between motor and top plate as shown in Figure 5-13. Adjustment is correct when no shift is visible when tape direction is changed and all screws are securely tightened.

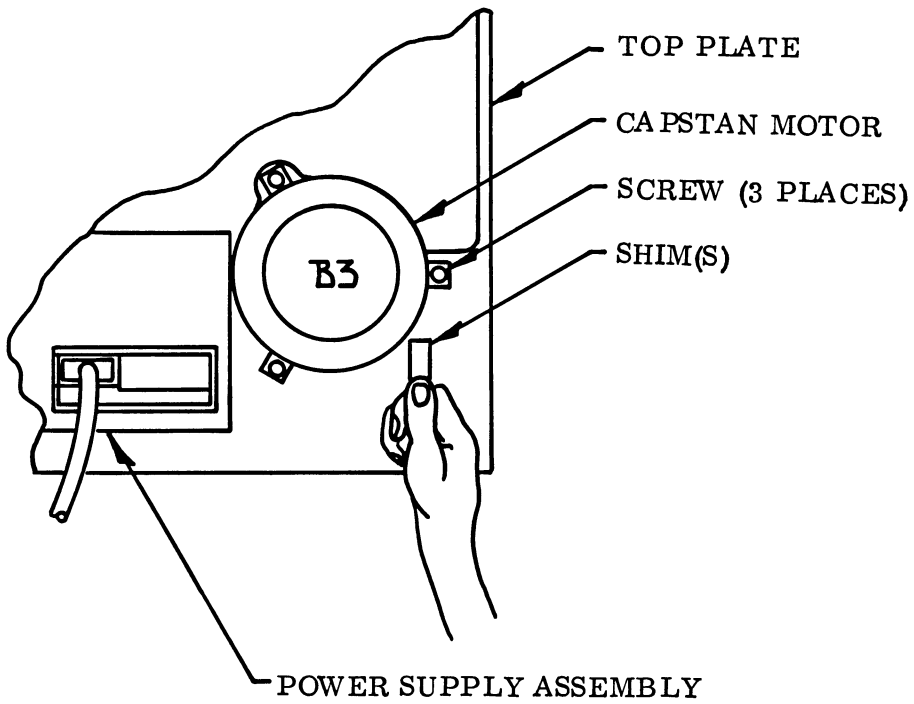


Figure 5-13. Motor Tilt Procedure

i. If tape moves toward top plate when running forward, capstan sleeve must be tilted toward head and guides. Slightly loosen two motor mounting screws closest to head and install mylar shim(s) between motor and top plate, centering shims 180° from screw indicated in Figure 5-13. Adjustment is correct when no shift is visible when tape direction is changed and all screws are securely tightened.

j. Run tape forward and reverse, and verify that tape is centered on reels and on capstan sleeve and that it does not shift or curl on any of tape guides or rollers.

k. Mount prerecorded master skew tape on transport and adjust head azimuth as outlined in paragraphs 5-39 through 5-42. Total skew (static and dynamic) must be less than 10% of a byte space in forward direction and 12% of a byte space in reverse direction of tape travel.

l. Reinstall facade, head cover, and EOT/BOT cover.

5-49. REEL HUB ADJUSTMENT. Referring to Figure 5-14, adjust the reel hub as follows:

a. Remove tape reel and leave lock open.

b. If lock has free play in open position, loosen locknut on adjustment setscrew. Turn adjustment setscrew into spacer until free play is removed, and tighten down locknut.

c. Close lock and note whether face of lock is parallel to top of cap. If not, open lock and turn buttonhead screw in or out as necessary to hold lock parallel to top of cap in closed position.

d. Place reel on hub, close lock, and check reel for tightness. If reel slips on hub, open lock and remove reel.

e. Loosen hex locknut on adjustment setscrew, turn adjustment setscrew slightly into spacer (depending upon looseness of reel), and retighten locknut.

f. Perform steps c and d.

g. Perform steps e, c, and d as necessary until reel does not slip.

NOTE

Hub compression ring contains oily preservative which tends to ooze out through pores and make surface oily. Ring should be cleaned

periodically with isopropyl alcohol to prevent tape reel from slipping.

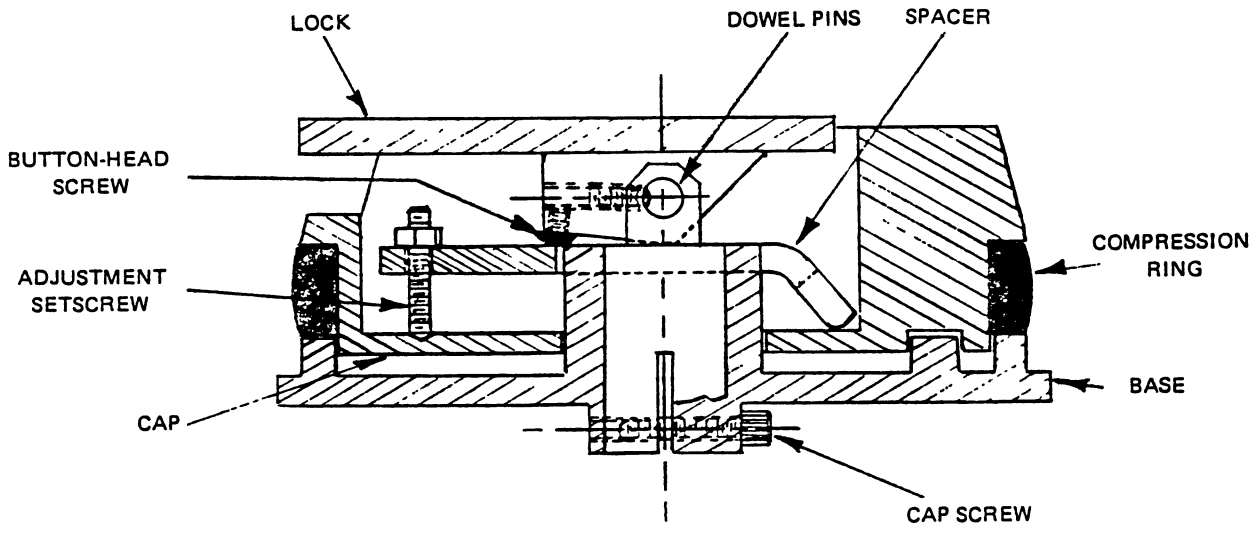


Figure 5-14. Reel Hub Assembly

5-50. REPLACEMENT OF ELECTRONIC ASSEMBLIES

5-51. These instructions are designed to guide the service engineer in a logical, step-by-step procedure for replacing assemblies.

5-52. CONTROL/SERVO BOARD. Replace the control/servo board in accordance with the following procedure:

a. Disconnect all cables from board.

b. Remove screws from corners of mounting bracket as shown in Figure 5-15.

c. Slide board out of top and bottom mounting brackets.

d. Slide in replacement board, and screw bracket back together at corners.

e. Reconnect all cables.

f. Turn on power and check power supply voltages.

g. Adjust control/servo in accordance with paragraphs 5-30 through 5-35 and 5-45.

5-53. DATA PWB. Replace the data PWB in accordance with the following procedure:

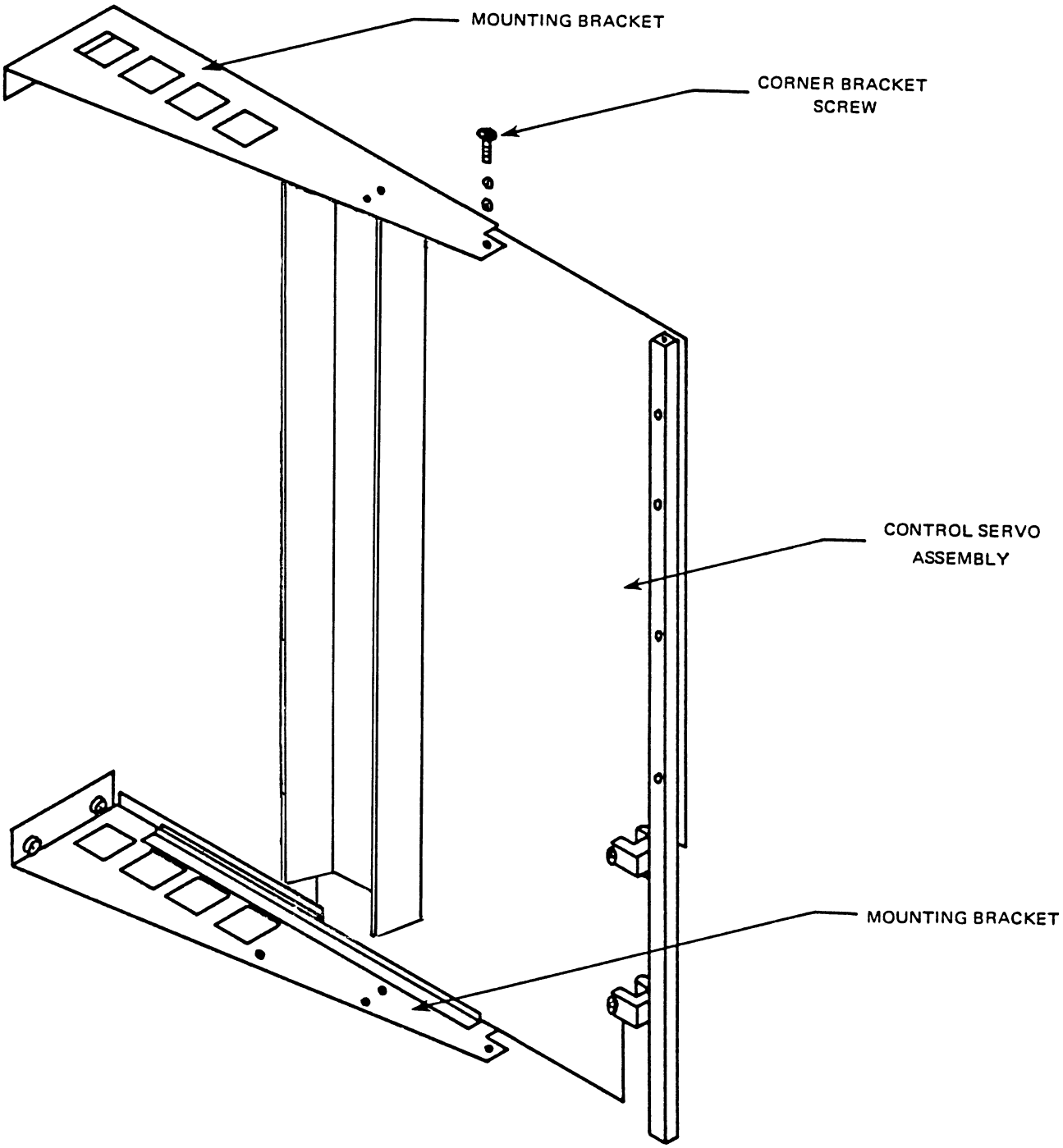


Figure 5-15. Control/Servo Board Removal

a. Remove two screws securing PWB to unhinged standoffs.

b. Swing PWB out on standoff hinges, and carefully remove head connectors and power/signal cable.

c. Support PWB, and remove two screws securing board to hinged standoffs.

d. Replace PWB in reverse sequence of removal.

e. Adjust new data PWB in accordance with paragraphs 5-36 through 5-44.

5-54. FILE PROTECT SENSOR. The complete file protect sensor is built and tested as an assembly and must be replaced as such. Removal and replacement procedures are as follows:

a. Unplug electrical connector from control/servo PWB.

b. Remove two screws securing sensor brackets and one screw securing cable clamp. Carefully pull cable and connector through hole provided in top plate casting.

c. Install replacement sensor in reverse order of removal. Adjust sensor-to-file protect ring distance to 0.100 inch. No electrical adjustments are required.

5-55. VACUUM FLOOR/TRANSDUCER ASSEMBLY. The 125-ips Model 900X transport has two vacuum floor assemblies (supply and takeup) to which one transducer assembly is bonded. Determine which vacuum floor assembly is at fault, and replace the complete assembly as follows:

NOTE

Vacuum floor assemblies consisting of a vacuum column floor and a transducer assembly can be returned to factory for repair at nominal charge.

a. Determine which assembly is at fault. Unplug corresponding connector body from control/servo PWB. Remove cable from connector body using Molex Tool Part No. HT-2038.

b. Loosen three press-lock fasteners securing defective vacuum floor/transducer assembly.

c. Remove screws securing four vacuum column walls and vacuum floor assembly to top plate. Save any shims under wall or vacuum floor assembly.

d. Lift floor/transducer assembly carefully from top plate. (When removing bottom floor/transducer assembly, take care not to damage capstan sleeve.) Disconnect silicone tubing from tee assembly in vacuum plenum chamber. Feed transducer cable through rubber grommet, and remove complete assembly.

e. Install replacement floor/transducer assembly in reverse order of removal. Push silicone tubing back over tee assembly, checking that all other tubing connections in vacuum plenum have not been disturbed. Replace any shims removed in step c or d.

f. Before tightening screws securing vacuum column walls, ensure that capstan sleeve does not rub on wall (in bottom vacuum chamber) closest to it and that roller guide does not rub against wall closest to it inside vacuum chamber.

g. Insert cable contacts into connector housing, as shown in Top Assembly Drawing No. 155000-000 (Section VII), and plug connector into corresponding control/servo PWB.

h. Adjust control/servo PWB as specified in paragraph 5-45.

5-56. REMOVAL AND REPLACEMENT OF ELECTRONIC PARTS AND COMPONENTS

5-57. Replacement parts and components should be selected from the parts list in Section VII. Use standard tools and procedures in removing and installing parts, with the assistance of the drawings in Section VII. Observe the following special procedures in removing parts from and installing them on printed circuit boards:

CAUTION

To prevent excessive heat from damaging printed circuit boards and components, especially semiconductors, use a soldering iron rated at not more than 40 watts or 600°F, and do not heat solder for more than 10 seconds. When soldering, always use heat sink (alligator clip, long-nose pliers, etc.).

a. Use only 60-40 tin-lead solder with noncorrosive, nonconducting flux. Use alcohol or commercial flux-removing solvent to remove flux residue.

b. After component has been removed from board, clean all solder from connections (plated-through holes) with commercial solder sucker (Soldapullt desoldering tool, Edsyn Co., or equivalent).

c. Use only exact replacement parts. (Refer to Section VII).

d. Do not alter wiring or layout.

5-58. MULTIPLE-LEAD COMPONENTS. Follow instructions presented in paragraph 5-57 for removal of a defective two- or three-lead component. Bend the leads on the replacement component to the proper shape and install. Heat may be applied to either side of the printed circuit board, as necessary.

5-59. MULTIPLE-PIN COMPONENTS. The following special instructions apply to the removal and replacement of multiple-pin components, including integrated circuits:

CAUTION

Exercise great care in the removal of multiple-pin components from printed circuit boards to avoid damage to boards.

a. Remove defective component by carefully cutting each lead close to component, using jeweler-type diagonal cutter.

b. Remove lead ends and solder from holes in board in accordance with instructions in paragraph 5-57.

c. Straighten leads in replacement component for insertion in board and install.

5-60. PROGRAMMING WRITE DESKEW PROM

5-61. Inscribed on the tape head of the Cipher Model 900X transport is an eight-digit code number which describes the deskew pattern to be programmed into the write deskew PROM (U90, Drawing No. 154040-009) to implement a write deskew pattern on the dual-mode data PWB for that head. The position of each digit in the code corresponds to a head channel number, starting with channel 7 on the left, to channel 0 on the right. The one exception is that position 2 of the code corresponds to channel P (parity). Channel 2 is the reference channel. The numerical value of each digit of the code corresponds to the address of its channel for which a 0 must be programmed into the PROM.

5-62. Tables 5-6, 5-7, and 5-8 are illustrative examples of bit maps of programmed PROMs required for three different hypothetical head codings. Column heading numbers correspond to head channel numbers (except for 2). Each 1 in the tables represents a logic high, and each 0 represents a logic low. Note that there is one and only one 0 in each bit column and that there are no 0's from address 10 to address 1F. There may be none, one, or more than one 0's in each of addresses (rows) 00 through 0F.

5-63. PROCEDURE. To program a PROM with a specific code, proceed as follows:

a. Obtain unprogrammed PROM, Cipher Part No. 203565-123 (82S123 or equivalent).

b. Note code on tape head with which PROM is to be used.

c. Program PROM in accordance with manufacturer's specifications to obtain logic lows at address/bit locations indicated by code and logic highs at all other locations.

NOTE

Most PROM distributors are equipped to program PROMS.

ADDRESS	BIT LOCATION 7	6	5	4	3	2	1	0
00	1	1	1	1	1	1	1	1
01	1	1	1	1	1	1	1	1
02	0	1	1	1	1	1	1	1
03	1	0	1	1	1	1	1	1
04	1	1	0	1	1	1	1	1
05	1	1	1	0	1	1	1	1
06	1	1	1	1	0	1	1	1
07	1	1	1	1	1	0	1	1
08	1	1	1	1	1	1	0	1
09	1	1	1	1	1	1	1	0
0A	1	1	1	1	1	1	1	1
0B	1	1	1	1	1	1	1	1
0C	1	1	1	1	1	1	1	1
0D	1	1	1	1	1	1	1	1
0E	1	1	1	1	1	1	1	1
0F	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1
1A	1	1	1	1	1	1	1	1
1B	1	1	1	1	1	1	1	1
1C	1	1	1	1	1	1	1	1
1D	1	1	1	1	1	1	1	1
1E	1	1	1	1	1	1	1	1
1F	1	1	1	1	1	1	1	1

Table 5-6. Bit Map, Code 23456789

ADDRESS	BIT LOCATION 7	6	5	4	3	2	1	0
00	1	1	1	1	1	1	1	1
01	1	1	1	1	1	1	1	1
02	1	1	1	1	1	1	1	1
03	1	1	1	1	1	1	1	1
04	1	1	1	1	1	1	1	1
05	1	1	1	1	1	1	1	1
06	1	1	1	1	1	1	1	1
07	0	0	0	0	0	0	0	0
08	1	1	1	1	1	1	1	1
09	1	1	1	1	1	1	1	1
0A	1	1	1	1	1	1	1	1
0B	1	1	1	1	1	1	1	1
0C	1	1	1	1	1	1	1	1
0D	1	1	1	1	1	1	1	1
0E	1	1	1	1	1	1	1	1
0F	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1
1A	1	1	1	1	1	1	1	1
1B	1	1	1	1	1	1	1	1
1C	1	1	1	1	1	1	1	1
1D	1	1	1	1	1	1	1	1
1E	1	1	1	1	1	1	1	1
1F	1	1	1	1	1	1	1	1

Table 5-7. Bit Map, Code 77777777

ADDRESS	BIT LOCATION 7	6	5	4	3	2	1	0
00	1	1	1	1	1	1	1	1
01	1	1	1	1	1	1	1	1
02	1	1	1	1	1	1	1	1
03	1	1	1	1	1	1	1	1
04	1	1	1	1	1	1	1	1
05	1	1	1	1	1	1	1	1
06	0	1	1	1	1	1	1	1
07	1	0	1	1	1	1	1	0
08	1	1	0	1	1	1	0	1
09	1	1	1	0	1	0	1	1
0A	1	1	1	1	0	1	1	1
0B	1	1	1	1	1	1	1	1
0C	1	1	1	1	1	1	1	1
0D	1	1	1	1	1	1	1	1
0E	1	1	1	1	1	1	1	1
0F	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1
1A	1	1	1	1	1	1	1	1
1B	1	1	1	1	1	1	1	1
1C	1	1	1	1	1	1	1	1
1D	1	1	1	1	1	1	1	1
1E	1	1	1	1	1	1	1	1
1F	1	1	1	1	1	1	1	1

Table 5-8. Bit Map, Code 6789A987

SECTION VI

TESTING AND TROUBLESHOOTING

6-1. TESTING

6-2. The Model 900X transport incorporates three separate types of internal testing facilities. These self-test and diagnostic systems detect certain fault conditions and provide alignment and test aids for preventive maintenance, all of them using built-in test controls at the operator control panel.

6-3. SELF TEST. During power-up operation, all indicator lights on the control panel will be illuminated for approximately 1 second. If all indicators except LOAD are extinguished following this period, no defect is indicated. If all indicators are illuminated, a defect in the ROM or microprocessor is indicated. If all indicators except LOAD remain illuminated, a defect in the RAM is indicated.

6-4. TEST MODE OPERATION. Off-line operation of the Model 900X in the test mode facilitates exercising of the transport for maintenance purposes without the use of an external text exerciser. The test mode, used primarily to set up and verify proper operation of the transport, is accessed by powering up the transport and loading a reel of tape.

6-5. Referring to Figure 3-1, which illustrates the controls and indicators of the Model 900X, the test modes, switch sequences for activating each mode, functions performed, and tests being made in each mode are as follows:

a. Press TEST and FWD pushbuttons momentarily. Transport performs alternate forward and stop operations to permit adjustment of start/stop ramp times. (See paragraph 5-35 for adjustment procedure.) To terminate test, press FWD pushbutton momentarily. FWD indicator is extinguished, and transport comes to stop.

b. Press REV pushbutton momentarily. Transport performs alternate reverse and stop functions to check start/stop ramp times. (See paragraph 5-35.) Press REV pushbutton momentarily to terminate.

c. Press FWD and REV pushbuttons momentarily while in TEST mode. Tape moves forward two unit times and reverse one unit time, continuing until EOT. Transport will then

perform rewind operation and continue forward and reverse operations. Purpose of this test is to check operation of servos. Reel hubs and capstan should operate simultaneously, starting, stopping, and turning in same direction.

6-6. DIAGNOSTIC MODE. The diagnostic mode is a more extensive mode of testing than the test mode. It is designed to aid troubleshooting by helping to locate and isolate fault conditions.

6-7. Referring to Figure 3-1, the upper three indicators on the control panel indicate, by base eight arithmetic, the number of the test being performed. Each of these, when illuminated, contributes its value to a number indicating the number of the test. The value of LOAD is 1, ON LINE is 2, and REWIND is 4. For example, if ON LINE is the only one illuminated, the test is number 2; if all are illuminated, it is number 7, etc. The remaining indicators are used to confirm proper operation of most of the major circuits in the transport.

6-8. To access the diagnostic mode, switch transport power to ON with no tape on the transport. Press simultaneously pushbuttons TEST, FWD, and WRT EN and hold, then press and hold in the LOAD pushbutton for 2 to 3 seconds. The LOAD indicator illuminates, after a slight delay, when Test 1 is accessed.

6-9. Test 1. This test enables all three servos, sequencing the reel hubs and capstan clockwise and counterclockwise and testing about 85% of the servo circuitry. Any polarity reversal will be detected, since a servo whose polarity is reversed will cause its reel to rotate in the opposite direction of the capstan motor.

6-10. To terminate this test, press the LOAD pushbutton momentarily. The LOAD indicator will be extinguished, and ON LINE will illuminate, indicating Test 2.

6-11. Test 2. Only the supply servo is activated in this test. Its purpose is to check operation of the modulated file-protect, EOT, and BOT sensors and electronics. While the supply reel rotates in one direction, displays for the BOT, EOT, quadrature phase 0, and phase 1 appear on the TEST, REV, HI DEN, and FWD indicators, respectively. These displays and their meanings in this test are as follows:

a. TEST illuminated, BOT operative; TEST extinguished, BOT defective.

b. REV illuminated, EOT operative; REV extinguished, EOT defective.

c. HI DEN flashing, WRT EN extinguished, quadrature phase 0 (paragraph 4-130) O. K. HI DEN flashing, WRT EN illuminated, phase 0 electronics defective. HI DEN extinguished, phase 0 sensor defective.

d. FWD flashing, WRT EN extinguished, quadrature phase 1 O. K. FWD flashing, WRT EN illuminated, phase 1 electronics defective. REV extinguished, phase 1 sensor defective.

6-12. To terminate Test 2, depress the LOAD pushbutton momentarily. LOAD and ON LINE indicators illuminate, indicating Test 3.

6-13. Test 3. This test is for diagnostic and repair purposes only. The rewind capstan circuitry is activated, and the capstan ramps up in a clockwise (rewind) direction, stops, and repeats this procedure until the test is terminated. Momentary actuation of the LOAD pushbutton at this point will illuminate the REWIND indicator (LOAD and ON LINE extinguished), accessing Test 4.

6-14. Tests 4, 5, 6, and 7. At Test 4, all servos are disabled to permit loading of tape for Tests 5 through 7. Mount a reel of tape and momentarily depress the LOAD pushbutton, loading the transport, accessing Test 5, and illuminating LOAD and REWIND indicators.

6-15. Refer to paragraph 5-45 for adjustment procedures performed in Tests 5, 6, and 7.

6-16. TROUBLESHOOTING

6-17. Before performing any troubleshooting operation, the technician must have a good understanding of the theory of operation of the transport and any associated equipment. He should check carefully to ensure that all equipment is connected properly and that all associated equipment is in good operating condition. He should be thoroughly familiar with operating instructions and follow them carefully in performing the troubleshooting procedure.

6-18. PROCEDURE. While it is recognized that each individual malfunction will require its own specific troubleshooting procedure, the following steps will serve as guidelines in the performance of any such operation:

a. As first step, inspect entire unit visually for any signs of damaged or overheated components. Also, listen for unusual noises, while transport is operating, which may indicate mechanical malfunctions.

b. When a defective component is located, identify it by referring to Section VII for part number and/or value.

c. If replacement part is available, substitute it for suspected defective part.

NOTE

If correction of any malfunction involves major realignment of transport, it is recommended that unit be returned to Cipher Data Products for factory repair and adjustment.

6-19. COMMON PROBLEMS. Table 6-1 lists common problems associated with operation of a tape transport, together with the probable cause and remedy for each.

6-20. SYSTEM TROUBLESHOOTING. Table 6-2, used in conjunction with the schematic diagrams in Section VII, provides an aid in the isolation of electrical/electronic system faults and their remedies.

TROUBLE	PROBABLE CAUSE	REMEDY
Reel flanges scrape tape	Reels improperly mounted	Reinstall reel evenly (See Section III)
BOT and EOT markers not sensed	Dirt covering reflective strip or sensor	Clean sensor or reflective strip
	EOT/BOT sensor or logic	Replace EOT/BOT assembly; repair logic
Tape fails to pull properly through machine or spills	Improper tape threading	Rethread tape (See Section III)
Excessive data dropout	Dirt on head or damaged tape	Clean head (Section V) and/or install new certified computer tape
Recorder will not function at all	Defective fuse	Replace fuse
POWER switch-light does not illuminate	No primary power	Check for primary power
	Defective indicator lamp	Replace control/ indicator

Table 6-1. Common Problems

TROUBLE	PROBABLE CAUSE	REMEDY
Machine does not accept commands	Improper interface	Check interface with DTL logic and correct as necessary
	More than one command true simultaneously	Enable only desired command; hold other inputs high
Tape continues to advance during Load mode	No BOT marker on tape	Affix marker to tape approximately 12 ft. from physical beginning of tape; place marker near reference edge on backing side of tape
Tape tensioned but does not advance when capstan turns	Tape not threaded over capstan properly	Rethread tape (See Section III)
Tape tensioned but slips	Dirty capstan	Clean capstan in accordance with Section V
Tape moves during a stop condition	Defective capstan assembly	Replace capstan assembly and realign servo
	Motor voltage not zero	Check capstan servo and adjust for zero offset; repair if adjustment does not correct
Tape not tensioned or tape is spilled when Ready mode is set	Improper tape threading	See Section III
	Reel servo or motor malfunctioning	Replace motor or repair reel servo
Transport responds to write commands but tape is not written	Write current not enabled	Check for write enable enable ring on reel; check write current command path to tape head; check that read is not enabled
Computer does not read tapes correctly	Data format incorrect	Use correct format
	Record length exceeds computer memory capability	Use correct record length

Table 6-1. Common Problems (Continued)

TROUBLE	PROBABLE CAUSE	REMEDY
Tape runs past BOT marker	BOT tab dirty or tarnished	Replace tab
	Photosensor or amplifier defective	Replace or repair photosensor assembly
Transport does not move tape in response to FORWARD or REVERSE commands	Interface cable fault or receiver fault	Check levels at outputs and inputs of receivers on servo board; replace or repair cable or repair cable or repair servo board
	Transport not in Ready mode	Bring tape to load point (Section III)
	Fault in ramp generator or capstan servoamplifier	Repair servo board
Transport responds to remote FORWARD command, but tape is not written	Write current is not enabled	Check presence of write enable ring on supply reel; WRT EN indicator should be illuminated. Check for +5V at write current transistor on write board while writing; if not present, check for +5V, at power connector. Also check for +5V on servo board.
	WRITE ENABLE signal not correct	Check receiver on control/power board; check for $\overline{\text{RUN}}$ signal on read/write board; repair read/write or control/power board if faulty
	Write data or write data strobe not received correctly from interface	Check presence of correct levels on write portion of read/write board; repair write portion of read/write board or interface cable if faulty
	Heads not plugged in correctly	Check J21 on read/write board

Table 6-2. System Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
Data are incorrectly written	Incorrect data format	Use correct format (See Section IV)
	Fault on one track due to failure in write circuits	Check receiver and write amplifier on write portion of read/write board; repair if faulty
	Intermittent +5, $\overline{\text{RUN}}$, or WARS	Examine signals and repair servo or read/write board, as required
	Write deskew circuit faulty	Check skew adjustments (See Section V)
	Head and guides need cleaning	Clean head and guides
	Tape cleaner needs emptying	Remove tape cleaner and clean
Tape cannot be read	Interface cable or transmitter faulty	Replace or repair interface cable or transmitter on read/write board
	Head not plugged in	Check J22 on read/write board
	Read skew out of adjustment	Readjust in accordance with Section V
	Head and guides need cleaning	Clean head and guides
	Tape cleaner needs emptying	Remove tape cleaner and clean
	Read amplifier gains incorrectly adjusted	Check and adjust amplifier gains
	Read data storage register faulty	Check read gate on read/write board; check that duration of positive section of waveform is one-half bit time
	Other component fault in read channel	Check test point data; repair read/write board

Table 6-2. System Troubleshooting (Continued)

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SECTION VII

ENGINEERING DOCUMENTATION

Parts lists, schematic diagrams, and assembly drawings applicable to the Model 900X transport are presented in this section.

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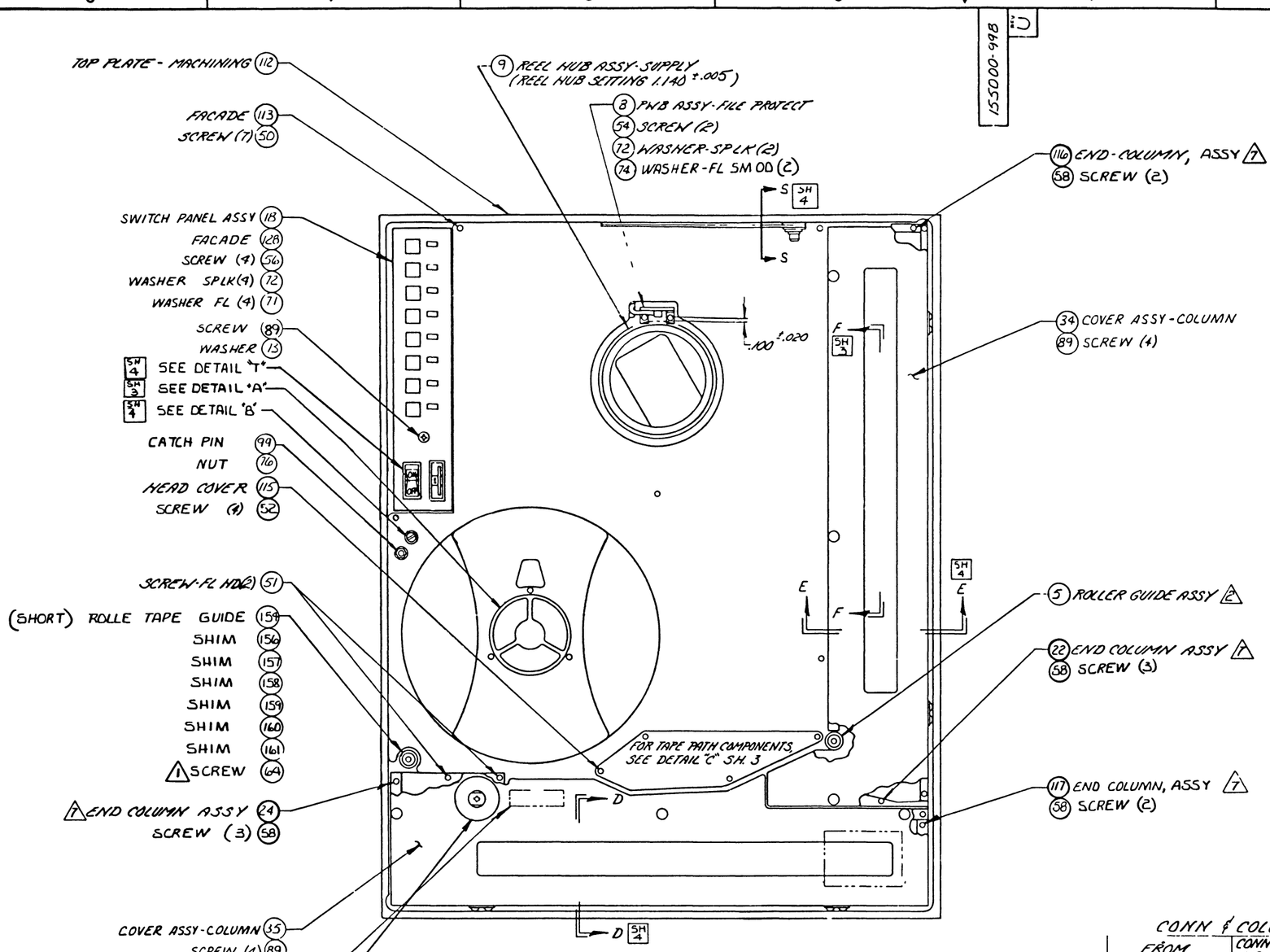


REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
A	ENGR - RELEASE	SS	10/3/14	MT	10/14
B	INCORP ECO 7123	LJ	2-25-80		2-26-80
C	INCORP ECO 7331	LJ	5-19-80		5-21-80
D	INCORP ECO 7839	LJ	7-28-80		7-28-80
E	INCORP ECO 8048	LJ	8-29-80		10-7-80
F	INCORP ECO 8198	LJ	9-18-80		10-7-80
G	INCORP ECO 8249	LJ	9-29-80		10-7-80
H	INCORP ECO 8269	LJ	10-13-80		10-13-80
J	INCORP ECO 8335	LJ	10-15-80		10-15-80
K	INCORP ECO 8388	LJ	10-13-80		10-15-80
L	INCORP ECO 8396	LJ	10-15-80		10-15-80
M	INCORP ECO 8512	LJ	11-5-80		11-7-80
N	INCORP ECO 8564	LJ	11-10-80		11-12-80
P	INCORP ECO 8857	LJ	12-28-80		12-31-80
R	INCORP ECO 8924	LJ	1-29-81		2-17-81
S	INCORP ECO 9375	LJ	2-3-81		2-17-81
T	INCORP ECO 9439	LJ	2-27-81		3-2-81
U	INCORP ECO 9396	LJ	3-3-81		3-16-81

NOTES:

△1 APPLY SCREWLOC LOCTITE, ITEM 79 AT INSTALLATION.

△2 REMOVE NUT & SHIM, ITEMS 8 & 18 OF ASSY 154002-101 AND SCREW ROLLER GUIDE TO TOP PLATE.

3 DUST DOOR REMOVED FOR CLARITY.

4 ITEMS NOT SHOWN: ITEM 11 - RACK MTG HDWR PKG, ITEM 109 - SHIPPING FRAME & ITEMS 47, 68, 69 - QTY 4 EA SHIPPING HARDWARE.

△5 CLEARANCE BETWEEN SENSOR & TAPE - .150 ± 020.

△6 CENTER PUMP BETWEEN REEL MOTORS, THEN PRESS IT DOWN TO ITS MAX TRAVEL, COMPRESSING GASKET, TIGHTEN SCREWS.

△7 .504 MAX DIM. FROM FLOOR TO TOP OF RAILS AFTER ASSY.

△8 APPLY .03 DIA BEAD (APPROX) OF RTV (ITEM 83) TO CORNERS INDICATED.

△9 LOCATE & FASTEN TY-RAPS - 1 EVERY 4 INCHES AS REQD.

△10 HOOK UP BLU & WHT WIRE FROM J27 PART OF 155005-003.

△11 PRESS IN DIRECTION OF ARROW FAR AS POSSIBLE, THEN TIGHTEN SCREW(S).

△12 CLEAN MATING SURFACES OF GASKET & TOP PLATE WITH INNIBISOL. WHEN THROUGHLY CLEAN, APPLY CONTACT CEMENT (ITEM 80) TO BOTH SURFACES. (TOP PLATE & GASKET). ALLOW CURLING TIME. THEN INSTALL GASKET TO TOP PLATE.

△13 APPLY RTV BETWEEN COVER & TOP PLATE TO EFFECT AN AIR-TIGHT SEAL.

14 SEE SCHEMATIC DIAGRAM 354000-998 FOR POWER DISTRIBUTION.

△15 GLUE ITEM 127 USING LOCTITE ITEM 79 AT INSTALLATION. LOCTITE MUST NOT SMEAR OUT FROM EDGES.

△16 REMOVE RETAINING NUT & SHIM BEFORE ASSY, REF DWG 154058-101.

△17 APPLY SCREWLOC, ITEM 94 AT INSTALLATION.

CONN & COLOR CODE TABLE

FROM	CONN NO.	CONN COLOR	TO PWB CONN	CONN COLOR
POWER SUPPLY	J14	YEL	P14 C/S*	YEL
B3-CAPSTAN	J8	RED	P8 C/S	RED
B2-SUPPLY	J10	BLK	P10 C/S	BLK
B1-TAKE-UP	J12	BLU	P12 C/S	BLU
XDUCER-SUPPLY	J25	GRN	P25 C/S	GRN
XDUCER-TAKE-UP	J26	BLK	P26 C/S	BLK
FILE PROTECT	J4	BLK	P4 C/S	BLK
EOT BOT	J5	RED	P5 C/S	RED
B5-VAC VALVE	J28	GRN	P28 C/S	GRN
TERM BLOCK ASSY	J29	BRN	P29 C/S	BRN
CONT SWITCHES	J3	RED	P3 C/S	RED
SWITCH-VAC SENSE	J27	GRN	P27 C/S	GRN
SWITCH-THUMBWHEEL	J30	RED	P30 C/S	RED
TAPE HEAD	J21	RED	P21 R/W	WRITE
TAPE HEAD	J22	YEL	P22 R/W	READ
CABLE-R/W TO C/S	J7	YEL	P7 C/S	YEL
	J20	GRN	P20 R/W	GRN

*C/S = CONTROL/SERVO

RCV STATUS OF SHEETS	RCV	U	N	M	U
	SH	1	2	3	4

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE DECIMALS XX ± .2, XXX ± .2, ANGLES ±2

DO NOT SCALE DRAWING

APPROVALS	DATE
DWN S.SCHNEIDER	11-27-79
CHK	11/30/79
MFG ENG	12/4/79
ELG DEV	12/6/79
MFG ENG	12/10/79
QC	12/10/79
QC ENG	12/14/79

Cipher Data Products SAN DIEGO CALIF

TITLE: MTT-0920, SANDCAST, UL

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	155000-998	U

SCALE 1/2 | 125 IPS | SHEET 1 OF 4

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
-	SEE SHEET 1				
B	INCORP ECO 7123	LJ	2-15-80		2-26-80
H	INCORP ECO 8269	LJ	10-3-80		10-15-80
J	INCORP ECO 8335	LJ	10-23-80		10-29-80
N	INCORP ECO 8569	LJ	11-10-80		11-10-80

155000-998 REV N

(49) SCREW
(79) ADHESIVE
(4) STANDOFF ASSY-HINGED
(129) STANDOFF
(63) SET SCREW △1
(1) REEL MOTOR ASSY
(47) SCREW (4) △1
EDGE ON CONN FARSIDE

BRACKET ASSY (12)
SCREW (2) (62)
WASHER-SP.LK. (2) (75)
WASHER-FL (2) (77)
(53) SCREW
(75) WASHER-SP.LK.
(77) WASHER-FL.
2 PLACES
(60) SET SCREW △1
ITEM 75 (REF)
(85) CABLE CLAMP
(53) SCREW
(72) WASHER-SP.LK.
(71) WASHER-FL.
(108) STANDOFF
2 PLACES
GROMMET (95)
PWB ASSY CONT/SERVO (20)
CABLE ASSY (3)
△6 VACUUM PUMP & BKT ASSY (36)
△12 GASKET (118)
CONTACT CEMENT (80)
△9 TY-RAP (86)
FILTER ASSY VENT (33)
ADHESIVE (82)
(2 PLACES)
△10 SWITCH (38)
SCREW (2) (57)
WASHER-SP.LK. (2) (72)
WASHER-FL. (2) (71)
GASKET (95)
GROMMET (95)
2 PLACES
COVER - PLENUM (120)
△13 RTV (81)
BRACKET ASSY (13)
SCREW (2) (62)
WASHER-SP.LK (2) (75)
WASHER-FL (2) (77)
△1 SET SCREW (60)
2 PLACES

(47) SCREW (9)
(68) WASHER-SP.LK. (9)
(69) WASHER-FL (9)
(6) FAN ASSY
(105) FASTENER (4)
(106) FILTER-FAN
(62) SCREW (9)
(75) WASHER-SP.LK (9)
(77) WASHER-FL. (9)
SEE DETAIL "B" (REF)
(28) REEL MOTOR ASSY
(90) SCREW (4) △1
(111) COVER-POWER SUPPLY
(61) SCREW (9)
(75) WASHER-SP. LK. (9)
(77) WASHER, FL. (9)
(19) CAPSTAN MOTOR ASSY
(107) CLAMP MOTOR MTG (3)
(123) SHIM
(124) SHIM
(125) SHIM
(98) SCREW (3)
(68) WASHER-SP LK (3)

TO P4
TO P28
TO P10
TO P30
TO P3
TO P12
TO P16 P21
TO P8
TO P5
TO P14
B2
B4
B6
B1
B3
G
G
5H

STANDOFF ASSY-HINGED (4)
STANDOFF (129)
△1 SET SCREW (63)
(93) SET SCREW △1
4 PLACES

(14) POWER SUPPLY ASSY
(46) SCREW (9)
(68) WASHER-SP.LK (9)
(110) LABEL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE DECIMALS .XX ± .0 .XXX ± .0 ANGLES	APPROVALS	DATE	Cipher Data Products SAN DIEGO CALIF
DO NOT SCALE DRAWING	DWN		TITLE MTT-0920, SANDCAST, UL
	CHK		
	MECH ENG		
	ELEC ENG		
	MFG ENG		SIZE D · CODE IDENT NO. 32274 · DRAWING NO. 155000-998 · REV N
	QC		
	DOC CTL		SCALE 1/2 · 125 OF 125 SHEET 2 OF 4

REVISION					
LTR	DESCRIPTION	OWN	DATE	APVD	DATE
	SEE SHEET 1				
B	INCORP ECO 7123	LJ	2-25-80	SA	2-26-80
E	INCORP ECO 8048	LJ	8-13-80	SA	10-7-80
F	INCORP ECO 8198	LJ	9-16-80	SA	10-7-80
G	INCORP ECO 8249	LRW	10-2-80	SA	10-7-80
H	INCORP ECO 8269	LJ	10-13-80	SA	10-15-80
M	INCORP ECO 8512	LJ	11-6-80	SA	11-7-80

155000-998 REV M

(10) VACUUM VALVE ASSY
(41) SCREW (2)
(72) WASHER-SP.LK.(2)
(71) WASHER-FL (2)

(49) SCREW (2)

(16) VALVE MOTOR ASSY
(53) SCREW (2)
(72) WASHER-SP. LK. (2)
(71) WASHER-FL.(2)

GROOVE PIN MUST NOT RUB ON VALVE HOUSING

B5

(94) CONNECTOR

CLEAR WIRE TO PIN 1

J28

BLACK WIRE TO PIN 2

VALVE PIN MUST TURN FREELY AFTER INSTALLATION. INSURE VALVE PIN DOESN'T RUB AGAINST SCREWS - ITEM 53

VIEW F-F
SCALE 1:1

(119) COVER-BRACKET
(61) SCREW (6)
(75) WASHER-SP.LK. (6)
(77) WASHER-FL (6)

C500

WHT WIRE

RED DOT

BLK WIRE

TERMINAL BLOCK ASSY REF SEE DETAIL H-H (SH 4)

VIEW G-G
SCALE 1/2

R

(75) WASHER-SP LK
(78) NUT

GRN/YEL WIRE FROM POWER SUPPLY

GRN WIRE FROM BLOWER

(163) STANDOFF
(55) SCREW, SET ⚠1

(85) CABLE CLAMP
(53) SCREW
(72) WASHER-SP.LK.
(71) WASHER-FL.

(17) TAPE GUIDE ASSY ⚠16

(2) TAPE SCRAPER ASSY ⚠11
(91) SCREW (2) ⚠1

(17) TAPE GUIDE ASSY ⚠11 ⚠16

(8) PWB ASSY-EOT/BOT (.150 ±.020 FROM TAPE) ⚠5
(54) SCREW (2)
(72) WASHER-SP.LK.(2)
(74) WASHER-FL. SM. OD. (2)

STANDOFF (114)
⚠1 SCREW, SET (55)

(15) REFLECTOR ASSY (.025 ±.005 FROM TAPE)
(54) SCREW ⚠1
(74) WASHER-FL. SM. OD.

DETAIL "C"
SCALE 1:1

(120) FACE PLATE
(62) SCREW (3)
(INSTALL AFTER FACADE)

ITEM 74 REF

.47 ±.03

(122) SURFACE PLATE
(51) SCREW (9)
(INSTALL AFTER FACADE)

(37) HUB ASSY

TOP PLATE (REF)

REEL MOTOR (REF)

DETAIL "A"
SCALE 1:1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE DECIMALS .XX ± .2 .XXX ± .2 ANGLES ±

DO NOT SCALE DRAWING

APPROVALS	DATE
OWN	
CHK	
MECH ENG	
ELEC ENG	
MFG ENG	
QC	
DOC CONT	

Cipher Data Products SAN DIEGO CALIF

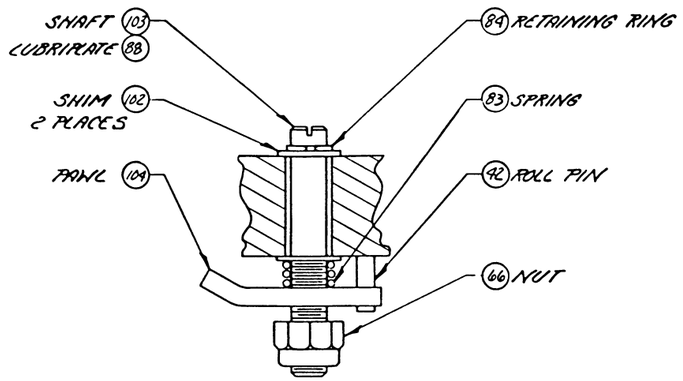
TITLE: MTT-0920, SANDCAST, UL

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	155000-998	M

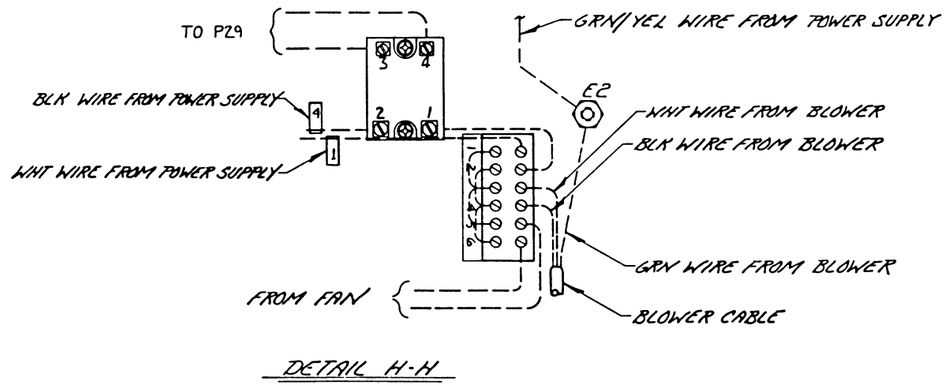
SCALE NONE 1.25 IPS SHEET 3 OF 4

155000-998 REV U

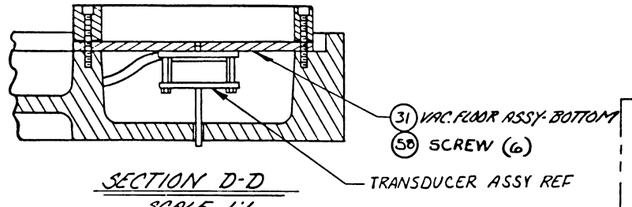
REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SHEET 1				
B	INCORP ECO 7123	LJ	2-25 81	JY	2-25 81
G	INCORP ECO 8249	CRW	10-28 80	JY	10-27 80
H	INCORP ECO 8269	LJ	10-13 80	JY	10-15 80
L	INCORP ECO 8396	LJ	10-23 80	JY	11-15 80
S	INCORP ECO 9375	LJ	2-3 81	JY	2-9 81
U	INCORP ECO 9396	LJ	3-5 81	JY	3-16 81



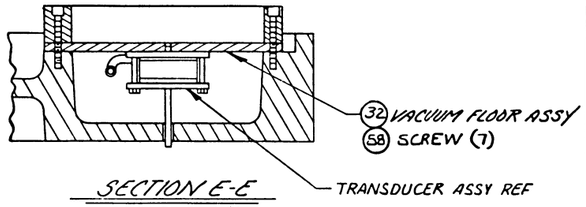
DETAIL "B"
SCALE: 2X1



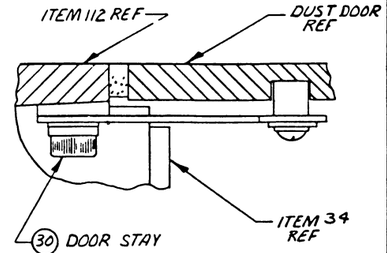
DETAIL H-H



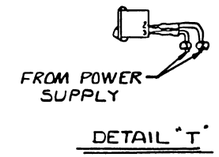
SECTION D-D
SCALE 1:1



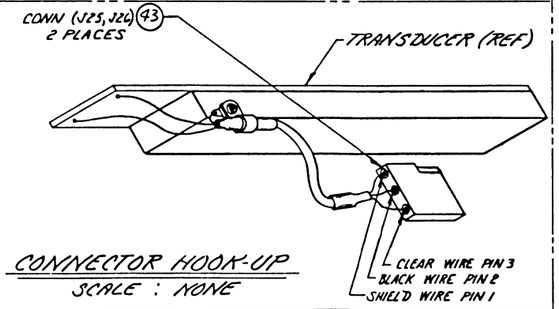
SECTION E-E
SCALE : 1X1



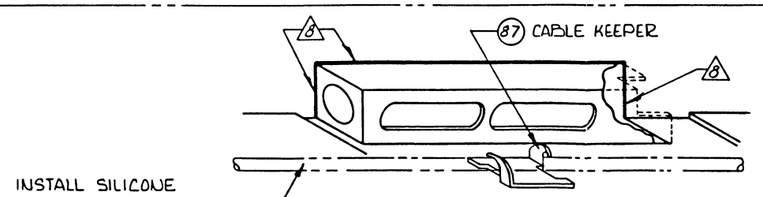
SECTION S-S
SCALE: NONE



DETAIL "T"

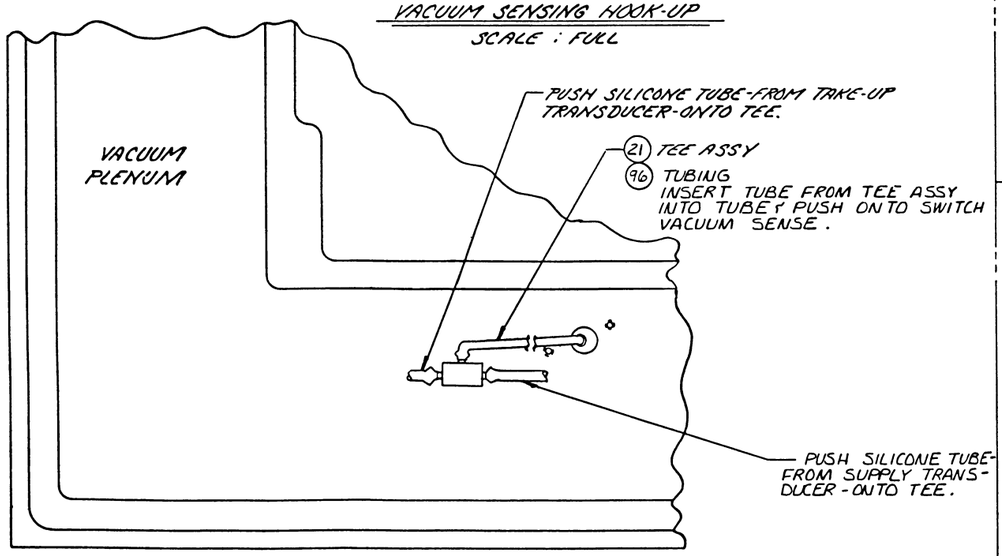


CONNECTOR HOOK-UP
SCALE : NONE



VACUUM VALVE - INSTALLATION
SCALE : NONE

VACUUM SENSING HOOK-UP
SCALE : FULL



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE DECIMALS .XX ± .2 .XXX ± .2 ANGLES ±

APPROVALS | DATE

DWN | CHK | MECH ENG | ELEC ENG | MFG ENG | QC | DOC SVCS

DO NOT SCALE DRAWING

Cipher Data Products SAN DIEGO CALIF

TITLE: MTT-0920, SANDCAST, UL

SIZE D | CODE IDENT NO. 32274 | DRAWING NO. 155000-998 | REV U

SCALE NOTED | WEIGHT LBS | SHEET 1 OF 1

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	131014-000	1	REEL MOTOR ASSY	CIPHER DATA PROD			
2	131047-002	1	TAPE SCRAPER ASSY	CIPHER DATA PROD			
3	131506-000	1	CABLE ASSY-R/W BOARD TO SERVO BOARD J7-J20	CIPHER DATA PROD			
4	131910-700	2	STANDOFF ASSY, HINGED	CIPHER DATA PROD			
5	154002-101	1	ROLLER GUIDE ASSY	CIPHER DATA PROD			
6	154003-001	1	FAN ASSY	CIPHER DATA PROD			
7	154048-502	1	CAPSTAN ASSY	CIPHER DATA PROD		03-01-81	L*180
8	154008-002	2	PWB ASSY-FILE PROTECT EOT/BOT *	CIPHER DATA PROD			
9	154010-801	1	REEL HUB ASSY-SUPPLY	CIPHER DATA PROD			
10	154010-902	1	VACUUM VALVE ASSY	CIPHER DATA PROD		05-15-81	L*190
11	154014-801	1	RACK MTG. HARDWARE	CIPHER DATA PROD			
12	154016-301	1	BRACKET ASSY-CONTROL/ SERVO	CIPHER DATA PROD			
13	154016-302	1	BRACKET ASSY-CONTROL/SVO	CIPHER DATA PROD			
14	154017-901	1	POWER SUPPLY ASSY	CIPHER DATA PROD			
15	154019-301	1	REFLECTOR ASSY	CIPHER DATA PROD			
16	154074-101	1	MOTOR ASSY-VALVE	CIPHER DATA PROD		05-15-81	L*102
17	154050-101	2	TAPE GUIDE ASSY	CIPHER DATA PROD			
18	153005-001	1	SWITCH PANEL ASSY	CIPHER DATA PROD			
19	153011-901	1	CAPSTAN MOTOR ASSY	ANY ACCEPTABLE SOURCE			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
20	155012-001	1	PWB ASSY-CONTROL/SERVO, 125 IPS	CIPHER DATA PROD			
21	155015-001	1	TEE ASSY-TRANSDUCERS	CIPHER DATA PROD			
22	155030-901	1	COLUMN ASSY-END	CIPHER DATA PROD			
23						04-13-01	L*191
24	155017-101	1	COLUMN ASSY-END,TAKEUP	CIPHER DATA PROD			
25						04-13-01	L*192
26						04-13-01	L*193
27						04-13-01	L*194
28	155018-001	1	REEL MOTOR ASSY-125 IPS	CIPHER DATA PROD			
29							
30	155020-101	1	ARM ASSY-DOOR STAY	CIPHER DATA PROD			
31	155022-501	1	FLOOR ASSY-TRANSDUCER, TAKE-UP	CIPHER DATA PROD		04-13-01	L*195
32	155022-601	1	FLOOR ASSY-TRANSDUCER, SUPPLY	CIPHER DATA PROD		04-13-01	L*196
33	155023-001	2	FILTER ASSY-VENT	CIPHER DATA PROD			
34	155024-101	1	COVER ASSY-COLUMN,SUPPLY	CIPHER DATA PROD			
35	155024-201	1	COVER ASSY-COLUMN,TAKEUP	CIPHER DATA PROD			
36	155027-301	1	VACUUM PUMP & BRACKET ASSY 125IPS	CIPHER DATA PROD			
37	155024-601	1	HUB ASSY-TAKE UP	CIPHER DATA PROD			
38	211075-310	1	SWITCH-DIFFERENTAL PRESSURE	FAIRCHILD PSF104-6			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
39							
40							
41	213271-405	2	SCREW-PAN HD PHIL, 4-40 X 5/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
42	205034-003	1	PIN, ROLL 1/8 X 7/8	ESNA 59-028-125-0875			
43	205073	2	CONNECTOR-HOUSING, 3 POS.	MOLEX,INC. 03-09-1032			
44	205076	1	CONNECTOR-3 POSN	MOLEX,INC. 03-09-1052			
45	205207-020	3	GROMMET-INSULATION	MINOR RUBBER CO. Z-3007			
46	213091-108	5	SCREW-SKT HD CAP 10-32 X 1/2,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
47	213092-110	12	SCREW-SKT HD CAP, 10-32 X 5/8 BLK	ANY ACCEPTABLE SOURCE			
48	213091-116	3	SCREW SOC HD,CAP 10-32 X 1	ANY ACCEPTABLE SOURCE 10-32X1"			
49	213622-402	3	SCREW-SKT SET KNURL CUP PT,4-40 X 1/8,BLK ONLY	ANY ACCEPTABLE SOURCE			
50	213274-404	7	SCREW-PAN HD,PHIL 4-40 X 1/4,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
51	213151-404	6	SCREW-FL HD PHIL,100, 4-40 X 1/4,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
52	213062-404	7	SCREW-BTN HD SKT, 4-40 X 1/4 BLK	4-40X1/4"BLACK			
53	213271-406	6	SCREW-PAN HD PHIL 4-40 X 3/8 CAD BLK ZINC	ANY ACCEPTABLE SOURCE			
54	213092-406	5	SCREW-SKT HD CAP, 4-40 X 3/8,BLK ONLY	ANY ACCEPTABLE SOURCE			
55	213351-408	4	SCREW-SKT SET CUP PT, 4-40 X 1/2,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
56	213271-409	4	SCREW-PAN HD PHIL, 4-40 X 9/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
57	213271-410	2	SCREW-PAN HD PHIL, 4-40 X 5/8,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
58	213092-412	23	SCREW-SKT HD CAP, 4-40 X 3/4,BLK ONLY	ANY ACCEPTABLE SOURCE		04-13-81	L#197

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
59							
60	213352-604	3	SCREW-SKT SET CUP PT, 6-32 X 1/4,BLK ONLY	ANY ACCEPTABLE SOURCE			
61	213271-606	10	SCREW-PAN HEAD PHIL, 6-32 X 3/8,CAD BLK,OR ZIN	ANY ACCEPTABLE SOURCE			
62	213091-606	8	SCREW-SKT HD CAP, 6-32 X 3/8,CAD),BLK,ZINC	ANY ACCEPTABLE SOURCE		07-01-81	L#184
63	213351-608	2	SCREW-SOC SET CUP PT, 6-32 X 1/2,CAD),BLK,ZINC	ANY ACCEPTABLE SOURCE			
64	213091-610	1	SCREW-SKT HD CAP 6-32 X 5/8,CAD),BLK,ZINC	ANY ACCEPTABLE SOURCE			
65							
66	207000-064	1	NUT-HEX,LIGHT,THIN	ESNA F			
67	207101-020	1	WASHER,FLAT, NYLON #10	#10 CAD			
68	207102-011	13	WASHER,SPLIT LOCK #10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			
69	207104-021	8	WASHER, FLAT,#10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			
70	207108-021	1	WASHER,FLAT, SMALL OD #10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			
71	207402-021	12	WASHER,FLAT #4	ANY ACCEPTABLE SOURCE			
72	207403-011	16	WASHER,SPLIT LOCK #4	ANY ACCEPTABLE SOURCE WASHER #4 CAD.			
73	207404-031	1	WASHER,INTERNAL LOCK #4	WASHER #4 CAD			
74	207408-021	5	WASHER,FLAT,SMALL OD #4	ANY ACCEPTABLE SOURCE			
75	207602-011	21	WASHER,SPLIT LOCK #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
76	207604-001	1	NUT-HEX RADIO PATTERN 6-32	ANY ACCEPTABLE SOURCE NUT #6 CAD.			
77	207605-021	20	WASHER,FLAT #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
78	207607-051	1	NUT, HEX #6 6-32	ANY ACCEPTABLE SOURCE NUT #6 CAD.			
79	209990-072	AR	ADHESIVE-LOCTITE *	LOCTITE 222			
80	209990-084	AR	CONTACT CEMENT	BORDEN CHEMICAL CO. E-533			
81	209990-109	AR	ADHESIVE,BLK-RTV	GENERAL ELECTRIC RTV-103			
82	209990-700	AR	PLASTIC ADHESIVE	MINNESOTA MINING 4475			
83	210003-001	1	SPRING,COMPRESSION	LEE SPRING CO. LC-032E-9MW			
84	210199-001	1	RING,RETAINING-CRESCENT	WALDES TRUARC 5103-25-H			
85	210229-090	2	CLAMP-CABLE, 1/8	NOT ON FILE 8910			
86	210229-523	19	TY-RAP-1/16 TO 5/8	ICO RALLY WRN 3 1/2			
87	210229-535	1	CABLE KEEPER-NYLON	WECKESSER CK25A			
88	210444	AR	LUBRIPLATE	G.C. ELECTRONICS 23-28			
89	213062-403	9	SCREW-BTN HD SKT,4-40 4-40 X 3/16 BLK	4-40X3/16 BLK			
90	213092-120	4	SCREW-SKT HD CAP, 10-32 X 1-1/4,BLK ONLY	ANY ACCEPTABLE SOURCE			
91	213091-422	2	SCREW-SKT HD CAP 4-40X1 3/8"				
92						07-01-81	L#187
93	213351-108	4	SCREW-SET SKT CUP POINT *	ANY ACCEPTABLE SOURCE 10-32X1/2			
94	209990-076	AR	RETAINING COMPOUND-FAST	LOCTITE 601			
95	754053-401	1	GASKET-SWITCH	CIPHER DATA PROD			
96	210462-002	.05	TUBING-FLEX,3/16 ID	PORT PLASTICS TYGON			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
97	154022-100	1	SHIPPING CARTON	CIPHER DATA PROD			
98							
99	731003-600	1	CATCH PIN-DUST DOOR	CIPHER DATA PROD			
100							
101	731042-000	1	WARNING LABEL-CAPSTAN	CIPHER DATA PROD			
102	731911-102	2	SHIM .005THICK 1/4 IN ID	CIPHER DATA PROD			
103	752003-601	1	SHAFT-LATCH	CIPHER DATA PROD			
104	752003-701	1	PAWL - LATCH	CIPHER DATA PROD			
105	754070-201	4	FASTENER-FILTER	CIPHER DATA PROD		07-01-81	L*105
106	754070-101	1	FILTER-FAN	CIPHER DATA PROD		07-01-81	L*106
107	754004-401	3	CLAMP-MOTOR MOUNTING	CIPHER DATA PROD			
108	754020-502	2	STANDOFF *	CIPHER DATA PROD			
109	754022-801	1	SHIPPING FRAME-100X/900X	CIPHER DATA PROD		03-01-81	L*109
110	754024-301	1	LABEL - FUSE REPLACEMENT	CIPHER DATA PROD			
111	154035-401	1	COVER ASSY-POWER SUPPLY	CIPHER DATA PROD			
112	755001-001	1	TOP PLATE-MACHINING	SEE DRAWING			
113	755001-901	1	FACADE-TOP PLATE	CIPHER DATA PROD			
114	755003-601	2	STANDOFF-HEADCOVER	CIPHER DATA PROD			
115	755003-901	1	HEAD COVER	CIPHER DATA PROD			

PARTS LIST 155000-998 MTT-0920,SANDCAST,UL REV U ECO# 9396 02-27-81 (PRINTED: 03-02-81) PAGE /
223 LINES

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
116	155038-401	1	COLUMN ASSY-END,SIDE	CIPHER DATA PROD		04-13-81	L=198
117	155038-501	1	COLUMN ASSY-END,BOTTON	CIPHER DATA PROD		04-13-81	L=199
118	755003-601	1	GASKET-VACUUM PUMP	CIPHER DATA PROD			
119	755003-801	1	COVER-BRACKET,PUMP	CIPHER DATA PROD			
120	755006-101	1	FACE PLATE-TAKEUP HUB	CIPHER DATA PROD			
121							
122	755006-401	1	PLATE-TAKE UP	CIPHER DATA PROD			
123	755018-301	1	SHIM-CAPSTAN MOTOR	CIPHER DATA PROD			
124	755018-302	1	SHIM-CAPSTAN MOTOR	CIPHER DATA PROD			
125	755018-303	1	SHIM-CAPSTAN MOTOR	CIPHER DATA PROD			
126	755018-301	1	COVER-PLENUM	CIPHER DATA PROD			
127	755018-901	1	WASHER-ADJUSTING	CIPHER DATA PROD			
128	755020-201	1	FACADE-SWITCH PANEL	CIPHER DATA PROD			
129	755026-101	2	STANDOFF-FNTR	CIPHER DATA PROD			
130						04-13-81	L=200
131						04-13-81	L=201
132						04-13-81	L=202
133						04-13-81	L=203
						04-13-81	L=204

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
135						04-13-01	L*205
136						04-13-01	L*206
137						04-13-01	L*207
138						04-13-01	L*208
139						04-13-01	L*209
140						04-13-01	L*210
141						04-13-01	L*211
142						04-13-01	L*212
143						04-13-01	L*213
144						04-13-01	L*214
145						04-13-01	L*215
146						04-13-01	L*216
147						04-13-01	L*217
148						04-13-01	L*218
149						04-13-01	L*219
150						04-13-01	L*220
151						04-13-01	L*221
152						04-13-01	L*222
153						04-13-01	L*223

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
154	716017-001	1	ROLLER TAPE GUIDE (SHORT)	CIPHER DATA PROD		05-01-81	L*171
155	799855-000	1	MANUAL-900X,125IPS,DUAL	CIPHER DATA PROD			
156	731513-001	1	SHIM,TAPE GUIDE .001 THK	CIPHER DATA PROD			
157	731513-002	1	SHIM,TAPE GUIDE .002 THK	CIPHER DATA PROD			
158	731513-003	1	SHIM,TAPE GUIDE .003 THK	CIPHER DATA PROD			
159	731513-004	1	SHIM,TAPE GUIDE .005 THK	CIPHER DATA PROD			
160	731513-005	1	SHIM,TAPE GUIDE .010 THK	CIPHER DATA PROD			
161	731513-006	1	SHIM,TAPE GUIDE .020 THK	CIPHER DATA PROD			
162	- 164 ARE BLANK.						
165	210030-172	2	STDOFF-3/16 HEX,1 1/2, 4-40	AMATOM ELECTRONIC HDW B119-A0440			10-12-80
166	- 169 ARE BLANK.						
170	**********						
171	799017-301	1	ROLLER GUIDE-CROWNED,125	CIPHER DATA PROD		L*154	04-30-81
172	- 182 ARE BLANK.						
183	754022-201	1	SHIPPING FRAME-900X *	CIPHER DATA PROD		L*109	07-20-81
184	213091-606	4	SCREW-SKT HD CAP, 6-32 X 3/8,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE		L*62	06-30-81
185	754002-401	1	HOUSING-FAN FILTER	CIPHER DATA PROD		L*105	06-30-81
186	754003-101	1	FILTER-FAN	CIPHER DATA PROD		L*106	06-30-81
187	213271-632	4	SCREW-PAN,HD,PHIL 6-32 X 2"	ANY ACCEPTABLE SOURCE		L*92	06-30-81

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
188	154004-002	1	CAPSTAN ASSY	CIPHER DATA PROD		L*7	02-28-81
189	154031-601	1	MOTOR ASSY VALVE	CIPHER DATA PROD		L*16	05-11-81
190	154010-902	1	VACUUM VALVE ASSY	CIPHER DATA PROD		L*10	05-11-81
191	155017-301	1	COLUMN ASSY-SIDE,RIGHT	CIPHER DATA PROD		L*23	04-12-81
192	155017-601	1	COLUMN ASSY-SIDE,LEFT	CIPHER DATA PROD		L*25	04-12-81
193	155017-801	1	SIDE COLUMN ASSY-BOTTOM	CIPHER DATA PROD		L*26	04-12-81
194	155017-901	1	SIDE COLUMN ASSY-BOTTOM	CIPHER DATA PROD		L*27	04-12-81
195	155021-801	1	FLOOR ASSY-TAKEUP	CIPHER DATA PROD		L*31	04-12-81
196	155021-901	1	FLOOR ASSY-SUPPLY	CIPHER DATA PROD		L*32	04-12-81
197	213092-412	35	SCREW-SKT HD CAP, 4-40 X 3/4,BLK ONLY	ANY ACCEPTABLE SOURCE		L*58	04-12-81
198	755004-201	1	END-COLUMN	CIPHER DATA PROD		L*116	04-12-81
199	755004-701	1	END-COLUMN,BOTTOM	CIPHER DATA PROD		L*117	04-12-81
200	755029-101	1	SHIM-TOP VACUUM COLUMN, LEFT RAIL	CIPHER DATA PROD		L*130	04-12-81
201	755029-102	1	SHIM-TOP VACUUM COLUMN, LEFT RAIL	CIPHER DATA PROD		L*131	04-12-81
202	755029-103	1	SHIM-TOP VACUM COLUMN, LEFT RAIL	CIPHER DATA PROD		L*132	04-12-81
203	755029-201	1	SHIM-TOP VACUUM COLUMN, RIGHT RAIL	CIPHER DATA PROD		L*133	04-12-81
204	755029-202	1	SHIM-TOP VACUUM COLUMN, RIGHT RAIL	CIPHER DATA PROD		L*134	04-12-81
205	755029-203	1	SHIM-TOP VACUUM COLUMN, RIGHT RAIL	CIPHER DATA PROD		L*135	04-12-81
206	755029-301	1	SHIM-BOTTOM VACUUM COLUMN ,TOP RAIL	CIPHER DATA PROD		L*136	04-12-81

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
207	755029-302	1	SHIM-BOTTOM VACUUM COLUMN ,TOP RAIL	CIPHER DATA PROD		L*137	04-12-81
208	755029-303	1	SHIM-BOTTOM VACUUM COLUMN ,TOP RAIL	CIPHER DATA PROD		L*138	04-12-81
209	755029-401	1	SHIM-BOTTOM VACUUM COLUMN ,BOTTOM RAIL	CIPHER DATA PROD		L*139	04-12-81
210	755029-402	1	SHIM-BOTTOM VACUUM COLUMN ,BOTTOM RAIL	CIPHER DATA PROD		L*140	04-12-81
211	755029-403	1	SHIM-BOTTOM VACUUM COLUMN ,BOTTOM RAIL	CIPHER DATA PROD		L*141	04-12-81
212	755029-501	1	SHIM-BOTTOM VACUUM COLUMN ,LEFT RAIL	CIPHER DATA PROD		L*142	04-12-81
213	755029-502	1	SHIM-BOTTOM VACUUM COLUMN ,LEFT RAIL	CIPHER DATA PROD		L*143	04-12-81
214	755029-503	1	SHIM-BOTTOM VACUUM COLUMN ,LEFT RAIL	CIPHER DATA PROD		L*144	04-12-81
215	755029-601	1	SHIM-BOTTOM VACUUM COLUMN ,RIGHT RAIL	CIPHER DATA PROD		L*145	04-12-81
216	755029-602	1	SHIM-BOTTOM VACUUM COLUMN ,RIGHT RAIL	CIPHER DATA PROD		L*146	04-12-81
217	755029-603	1	SHIM-BOTTOM VACUUM COLUMN ,RIGHT RAIL	CIPHER DATA PROD		L*147	04-12-81
218	755029-701	1	SHIM-TOP VACUUM COLUMN, TOP RAIL	CIPHER DATA PROD		L*148	04-12-81
219	755029-702	1	SHIM-TOP VACUUM COLUMN, TOP RAIL	CIPHER DATA PROD		L*149	04-12-81
220	755029-703	1	SHIM-TOP VACUUM COLUMN, TOP RAIL	CIPHER DATA PROD		L*150	04-12-81
221	755030-701	1	SHIM-TOP VACUUM COLUMN BOTTOM RAIL	CIPHER DATA PROD		L*151	04-12-81
222	755030-702	1	SHIM-TOP VACUUM COLUMN BOTTOM RAIL	CIPHER DATA PROD		L*152	04-12-81
223	755030-703	1	SHIM-TOP VACUUM COLUMN BOTTOM RAIL	CIPHER DATA PROD		L*153	04-12-81

PARTS LIST 154004-001 CAPSTAN ASSY REV C ECO# 7489 05-19-80 (PRINTED: 05-19-80) PAGE 1
8 LINES OF 1

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754004-201	2	SHELL-CAPSTAN	CIPHER DATA PROD			
2	754004-301	1	HUB-CAPSTAN	CIPHER DATA PROD			
3							
4							
5	210201-901	1	RING,TOLERANCE	ROLLER BEARING CO.,AMER. AN031025			
6							
7							
8	209990-107	AR	CONTACT CEMENT-PERMABOND	PEARL CHENICAL CO. 101			

PARTS LIST 154004-002 CAPSTAN ASSY REV C ECO# 7489 05-19-80 (PRINTED: 05-19-80) PAGE 1
8 LINES OF 1

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754004-201	2	SHELL-CAPSTAN	CIPHER DATA PROD ----------			
2	754004-302	1	HUB-CAPSTAN	CIPHER DATA PROD ----------			
3							
4							
5	210201-902	1	RING,TOLERANCE	ROLLER BEARING CO.,AMER. AN037025			
6							
7							
8	209990-107	AR	CONTACT CEMENT-PERMABOND	PEARL CHENICAL CO. 101			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754005-101	1	PWB-SWITCHES	CIPHER DATA PROD ----------			
2							
3	208500-056	2.75	CABLE-STRD,PVC,8 COND	ALPHA WIRE CORP. 3308			
4	208415-112	.5	WIRE-STRD-22AWG,IRPVC,BLK	JUDD WIRE HH0314			
5	210408-024	.3	TUBING-SHRINK,BLACK	ICO RALLY HIX 3/8			
6							
7	205067	1	CONNECTOR HOUSING-9 POSN	MOLEX,INC. 03-09-1093	J3		
8	205014	1	TERM-MALE,18-22AWG,.093 DIA, REEL	MOLEX,INC. 02-09-2116	PIN1		
9	205211-100	8	TERM-FEM 24-30AWG .093 DIA REEL	MOLEX,INC. 02-09-1142	PIN2-9		
ALT	205211-101		TERM-FEM,24-30AWG,.093 DIA LOOSE	MOLEX,INC. 02-09-1144			
10							
11	210806-500	8	SWITCH-PUSH BUTTON,MOM	ROOD SWITCH RS5035	S1-8		
12	203052-259	1	IC-MULTIPLEXER/3 ST OUT	TEXAS INSTRUMENTS SN74259	U1		
13	203052-251	1	IC-8BIT ADDRESSABLE LATCH	TEXAS INSTRUMENTS SN74LS251N	U2		
14	205249	1	RESISTOR NETWORK-10K, 14 PIN *	BECKMAN INSTRUMENTS,INC. 899-1-R10K	U3		
15							
16	212000-101	8	DIODE-LIGHT EMITTING RED	HEWLET PACKARD 5082-4670	CR1-8		
17	200072-220	8	RES FC 220 OHM 1/4W 5%	NOT ON FILE RCR07G221JM	R1-8		
18	201149-470	1	CAP FC .047UF 50V 5%	EL PAC C5A473J	C1		
19	201105-010	1	CAP,CER,DISC,.01UF,500V	SPRAGUE 5HKS-S10	C2		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
20	210032-100	4	STDOFF-1/8 RND,1/16 4-40,SWAGE	AMATOM ELECTRONIC HDW 9531B-A-0440			
21	354005-301	REF	SCHEM-PWB,SWITCHES	CIPHER DATA PROD			
22	210229-200	1	CLAMP,CABLE-3/16 WHITE	NOT ON FILE 3303			
23	211107-550	2	FERRULE UN-INSULATED GREEN	AMP INC. 323934			
24	213271-607	1	SCREW-FAN HD PHIL, 6-32 X 7/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
25	207605-021	1	WASHER,FLAT #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
26	207602-011	1	WASHER,SPLIT LOCK #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
27	207607-051	1	NUT, HEX #6 6-32	ANY ACCEPTABLE SOURCE NUT #6 CAD.			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	154014-901	1	HINGE BLOCK ASSY	CIPHER DATA PROD			
2							
3	154014-902	1	HINGE BLOCK ASSY	CIPHER DATA PROD			
4	731002-300	1	SAFETY BLOCK,TOP PLATE	CIPHER DATA PROD			
5							
6	213021-112	6	SCREW-BDR HD SLOT, 10-32 X 3/4,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
7	213091-408	1	SCREW-SKT HD CAP 4-40 X 1/2,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
8	210028	2	WASHER,FL,NYL,#10X.062 TK	AMATOM ELECTRONIC HDW 2319-N194			
9	209998-066	1	POLY BAG-3MIL,3 X 6	RICO PLASTIC 3 X 6			
10	211200-160	1	LABEL-MOUNTING HARDWARE 2" X 3"	ANY ACCEPTABLE SOURCE ORDER BY DESC			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754009-901	1	REEL HUB MODIFICATION	CIPHER DATA PROD			
2	731910-200	1	CAP-REEL HUB	CIPHER DATA PROD			
3	731922-300	1	LOCK-REEL HUB MACHINING	CIPHER DATA PROD			
4	731922-202	1	REEL HUB-SPACER,ADJ,MOD	CIPHER DATA PROD		09-01-81	L*22
5	710010-400	1	COMPRESSION RING REEL HUB	CIPHER DATA PROD			
6	154002-601	1	RING ASSY-FILE PROTECT	CIPHER DATA PROD			
7	731013-400	2	PIN,REEL HUB	CIPHER DATA PROD			
8	754003-501	3	CONICAL CPRSN SPRING	CIPHER DATA PROD			
9	213062-604	1	SCREW-BTN HD SKT 6-32 X 1/4 BLK O	ANY ACCEPTABLE SOURCE			
10	213622-610	1	SCREW-SKT SET,KNRL CUP PT 6-32 X 5/8,BLK ONLY	ANY ACCEPTABLE SOURCE			
11	207604-081	1	NUT-HEX RADIO PATTERN 6-32	ANY ACCEPTABLE SOURCE NUT #6 CAD,			
12	210029-003	3	NUT-HEX,LIGHT,THIN #4	ESNA 22NTN-40			
13	209990-076	AR	RETAINING COMPOUND-FAST	LOCTITE 601			
14	213092-612	2	SCREW-SKT HD CAP, 6-32 X 3/4,BLK ONLY	ANY ACCEPTABLE SOURCE			
15	213352-604	2	SCREW-SKT SET CUP PT, 6-32 X 1/4,BLK ONLY	ANY ACCEPTABLE SOURCE			
16	213351-410	3	SCREW-SKT,SET,CUP,PT,CAD, BLK,ZINK,40-40X,5/8	ANY ACCEPTABLE SOURCE			
17	209999-031	AR	STP OIL TREATMENT	209999-031			
18	209990-075	AR	VIBRA-TITE	VC 3			
19	* REF DWG 600103-100 REEL HUB ASSY-PROCEDURE						
20							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
21	**********						
22	731922-201	1	REEL HUB-SPACER,ADJ,MOD	CIPHER DATA PROD		L*4	08-31-81

PARTS LIST 755001-001 DOOR ASSY-DUST COVER REV C ECO# 4520 11-13-78 (PRINTED: 01-11-81) PAGE 1
12 LINES OF 1

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	755001-701	1	DOOR-DUST COVER	UL-BOLERO PLASTICS			
2							
3	731920-900	1	LATCH-DUST DOOR	CIPHER DATA PROD			
4							
5	799003-800	2	HINGE - FLAT 1 X 1	CIPHER DATA PROD			
6							
7	211113-600	7.5	TAPE-FLAME RETARDANT POLYURETHANE	BURNETT & CO. UNIFOAM N 582N			
8							
9	213062-408	2	SCREW-BTN HD SKT, 4-40 X 1/2,BLK ONLY	ANY ACCEPTABLE SOURCE			
10	213062-605	4	SCREW-BTN HD SKT 6-32 X 5/16,BLK ONLY	ANY ACCEPTABLE SOURCE			
11							
12	207408-021	2	WASHER,FLAT,SMALL OD #4	ANY ACCEPTABLE SOURCE			

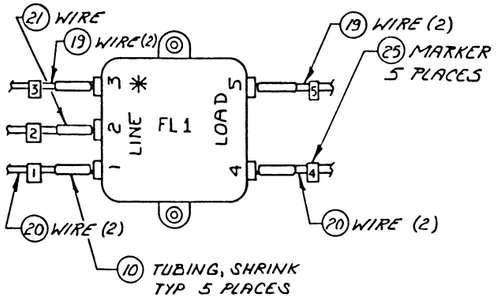
ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	755002-601	1	COVER-COLUMN,BOTTOM	CIPHER DATA PROD			
2	755016-601	1	FACADE-COLUMN,TAKEUP	CIPHER DATA PROD			
3	755002-901	1	GLASS-SIDE COLUMN	CIPHER DATA PROD			
4	713005-700	2	HINGE-DUST DOOR	CIPHER DATA PROD			
5							
6	205209-001	3	LATCH - GROMMET *	HARTWELL CORP. HN4G-44-1			
7	205209-002	3	LATCH - PLUNGER *	HARTWELL CORP. HN4P-44-4-1			
8 - 10 ARE BLANK.							
11	213062-404	4	SCREW-BTN HD SKT, 4-40 X 1/4 BLK	4-40X1/4"BLACK			
12	209990-800	AR	ADHESIVE-STRL,SYN RESIN	MINNESOTA MINING 3520 B/A			
ALT	209990-300		ADHESIVE-STRL,MOD EPOXY	MINNESOTA MINING 2216 B/A CLEAR AMBER			
13	209990-072	AR	ADHESIVE-LOCTITE *	LOCTITE 222			

PARTS LIST 155016-001 COVER ASSY-COLUMN,SIDE REV C ECO# 5348 03-29-79 (PRINTED: 01-11-81) PAGE 1
14 LINES OF 1

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	755002-701	1	COVER-SIDE COLUMN	CIPHER DATA PROD			
2	755016-101	1	FACADE-COLUMN,SUPPLY	CIPHER DATA PROD			
3	755002-901	1	GLASS-SIDE COLUMN	CIPHER DATA PROD			
4	713005-700	2	HINGE-DUST DOOR	CIPHER DATA PROD			
5							
6	205289-001	3	LATCH - GROMMET *	HARTWELL CORP. HN4G-44-1			
7	205289-002	3	LATCH - PLUNGER *	HARTWELL CORP. HN4P-44-4-1			
8	- 10 ARE BLANK.						
11	213062-404	4	SCREW-BTN HD SKT, 4-40 X 1/4 BLK	4-40X1/4"BLACK			
12	209990-800	AR	ADHESIVE-STRL,SYN RESIN	MINNESOTA MINING 3520 B/A			
ALT	209990-300		ADHESIVE-STRL,MOD EPOXY	MINNESOTA MINING 2216 B/A CLEAR AMBER			
13	209990-072	AR	ADHESIVE-LOCTITE *	LOCTITE 222			
14	210040-096	104	CORD-NEOPRENE,1/16 DIA	ROYAL IND. SEE CAT SHEET			
ALT	210040-095		CORD-NEOPRENE,3/32 DIA	ROYAL IND. SEE CATALOG SHEET			

PARTS LIST 154019-801 VACUUM PUMP ASSY REV K ECO# 9672 03-20-81 (PRINTED: 03-20-81) PAGE 1
14 LINES OF 1

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	799017-101	1	BLOWER-MOTOR DRIVEN	CIPHER DATA PROD			
2	754052-801	1	SHIELD-VACUUM BLOWER, CLAMP	CIPHER DATA PROD			
3							
4	754019-501	1	AIR DEFLECTOR *	UL-BOLERO PLASTICS			
5	210555-032	2	TERMINAL-SLIP-ON,.250 TAB	HOLLINGSWORTH TERM. CO. S05300F-T1 OR T2			
6	210408-032	.2	TUBING-SHRINK,BLK	ICO RALLY HIX 1/2			
7							
8	210085-150	1	CLAMP-SHIELD,3-5/16 TO 4-1/4	MURRAY 60			
9	210555-025	3	TERMINAL RING #6 SN FAT	HOLLINGSWORTH TERM. CO. R1881S			
10	210229-516	1	TY-RAP-8"	PANDUIT PLT2I			
11	209990-700	AR	PLASTIC ADHESIVE	MINNESOTA MINING 4475			
12							
13	**********						
14							



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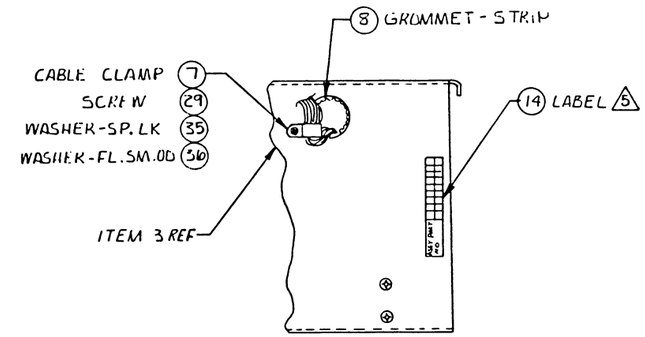

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SCALE: 1:1

DETAIL "B"
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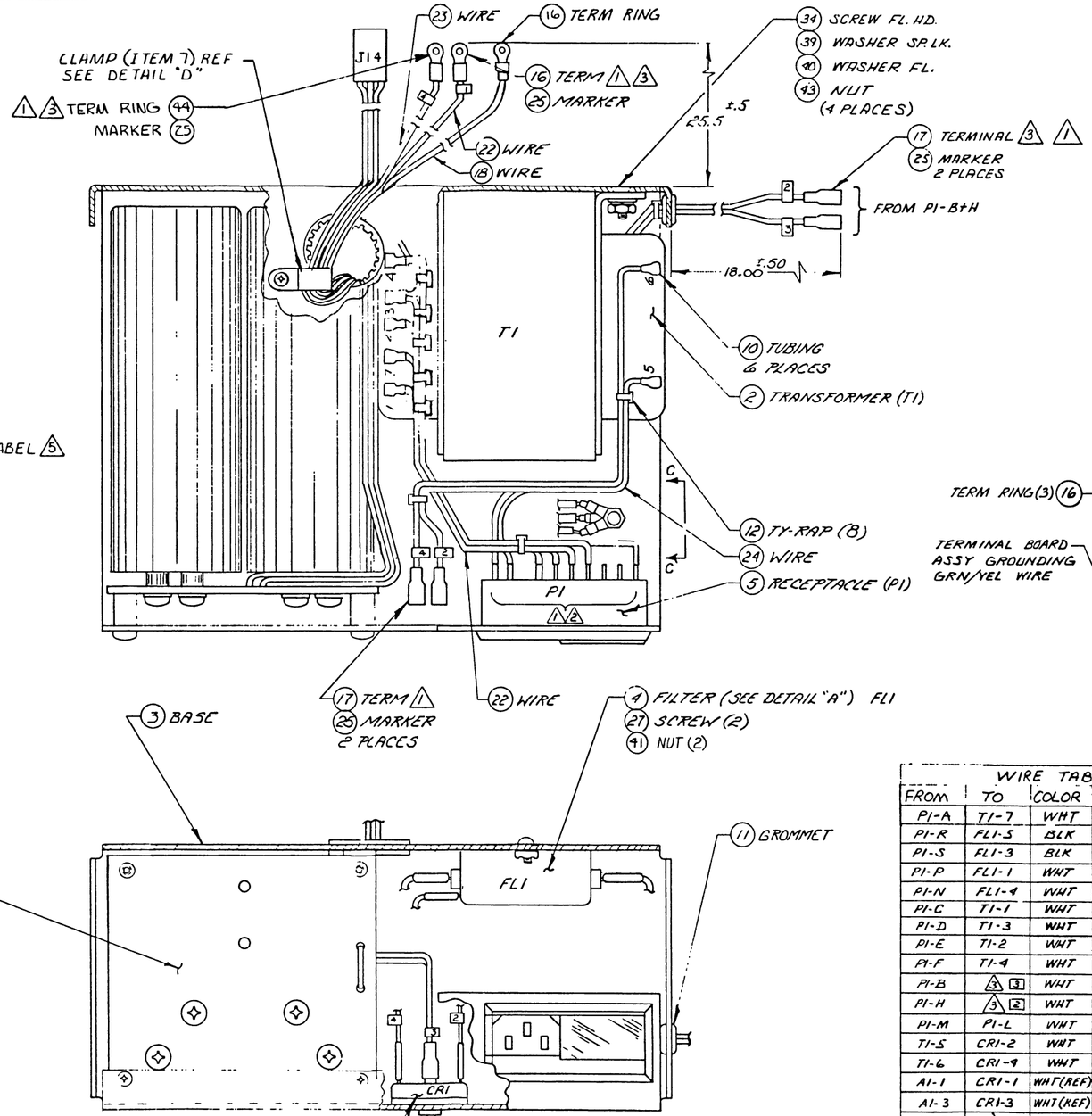
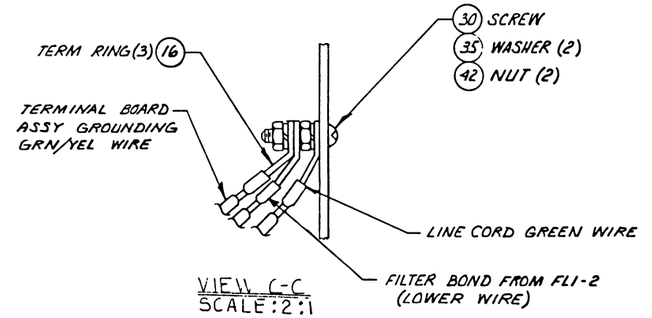




VIEW C-C
SCALE: 2:1

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
A	ENGR REL	DS	3-17-78		3-17-78
B	INCORP ECO 3706	RA	5-15-78		5-15-78
C	INCORP ECO 3733	RA	5-15-78		5-15-78
D	INCORP ECO 3898	RA	6-7-78		6-7-78
E	INCORP ECO 4005	RA	8-23-78		8-23-78
F	INCORP ECO 4208	RA	9-12-78		9-12-78
G	INCORP ECO 4317	RA	2-12-79		2-12-79
H	INCORP ECO 5244	LJ	5-30-79		5-30-79
J	INCORP ECO 5413	LJ	6-11-79		6-11-79
K	INCORP ECO 5622	LJ	5-8-79		5-11-79
L	INCORP ECO 5803	LJ	6-13-79		6-14-79
M	INCORP ECO 5897	LJ	6-28-79		7-3-79
N	INCORP ECO 6040	LJ	7-19-79		7-20-79
P	INCORP ECO 6932	LJ	10-15-79		10-22-79
R	INCORP ECO 6652	LJ	11-7-79		11-12-79
S	INCORP ECO 7032	LJ	3-13-80		3-19-80
T	INCORP ECO 7223	LJ	3-25-80		3-31-80
U	INCORP ECO 7491	LJ	5-27-80		6-2-80
V	INCORP ECO 8243	CRW	9-19-80		9-23-80
W	INCORP ECO 8561	LJ	11-12-80		11-14-80
Y	INCORP ECO 9824	LJ	4-6-81		4-7-81
Z	INCORP ECO 9877	LJ	5-13-81		5-14-81
AA	INCORP ECO 9618	LJ	5-13-81		5-14-81

WIRE TABLE				
FROM	TO	COLOR	AWG	LG
P1-A	T1-7	WHT	16	10.0
P1-R	FL1-5	BLK	18	5.0
P1-S	FL1-3	BLK	18	5.0
P1-P	FL1-1	WHT	18	5.0
P1-N	FL1-4	WHT	18	5.0
P1-C	T1-1	WHT	16	10.0
P1-D	T1-3	WHT	16	11.0
P1-E	T1-2	WHT	16	10.0
P1-F	T1-4	WHT	16	11.0
P1-B	3 3	WHT	16	27.0
P1-H	3 2	WHT	16	27.0
P1-M	P1-L	WHT	16	1.5
T1-5	CR1-2	WHT	19	11.0
T1-6	CR1-4	WHT	19	13.0
A1-1	CR1-1	WHT (REF)	–	–
A1-3	CR1-3	WHT (REF)	–	–
T1-3	3 4	BLK	16	31.5
T1-4	3 7	WHT	16	31.5
P1-GND	E1	GRN	18	3.5
E1	FL1-2	GRN	18	7.0
E1	E2	GRN/YEL	16	37.0

154017-901
REV AA

3 INSTALL LABEL AS SHOWN APPROX. CENTERED AND 1/4 INCH FROM EDGE. ENTER PART NO. AND REVISION LEVEL OF POWER SUPPLY.

4. FOR SCHEMATIC DIAGRAM SEE DRAWING 354000-998.

3 ROUTE WIRES THROUGH GROMMET BEFORE CRIMPING & TERMINATE AS SHOWN.

2 COVER ALL SOLDER CONNECTIONS WITH SHRINK TUBING.

1 SEE WIRE TABLE FOR WIRE CALLOUT & DESTINATION.

DRAWING NO 154017-901
SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ±1/32 DECIMALS .XX ±.01 .XXX ±.005 ANGLES ±.5°
DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS		DATE
DSN		2-2-78
CHK		3-17-78
MFG ENGR		3-17-78
QC		3-17-78
COG SUPR		
PROD MGR		3-17-78

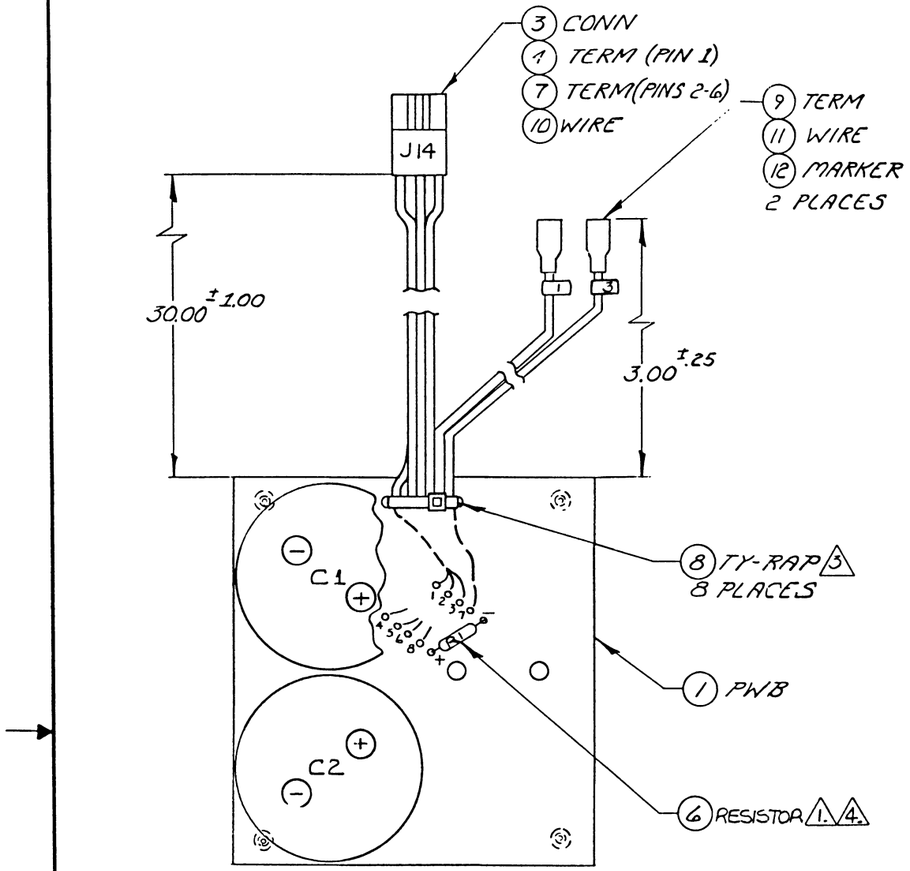
Cipher Data Products SAN DIEGO CALIF

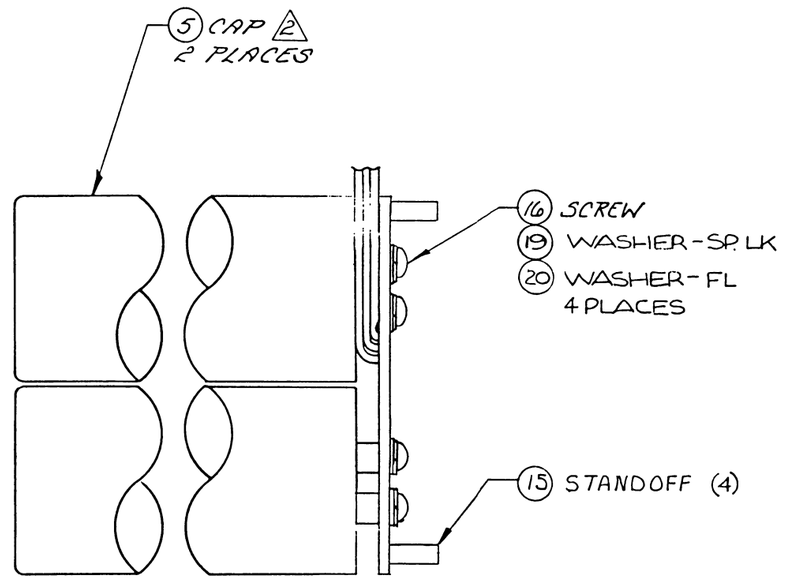
TITLE: POWER SUPPLY ASSY

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	154017-901	AA

SCALE FULL 2/3X SHEET 1 OF 1

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
A	ENGR REL	DS	3-16-78	[illegible]	3-17-78
B	INCORP ECO 3675	CW	5/1/78	[illegible]	5-4-8
C	INCORP ECO 4338	CW	10-20-78	[illegible]	10-23-8
D	INCORP ECO 5412	LJ	9/19-79	[illegible]	9-23-9
E	INCORP ECO 5560	LJ	4-30-79	[illegible]	5-1-9





154017-001 REV E

CONN-ITEM 3

WIRE SIDE VIEW

WIRE TABLE

WIRE ITEM NO.	FROM PWB PIN NO.	TO WIRE MARKER NO.	TO CONN PIN NO.	TERM TYPE
10	1	—	1	MALE
10	2	—	2	FEMALE
10	3	—	3	FEMALE
10	4	—	4	FEMALE
10	5	—	5	FEMALE
10	6	—	6	FEMALE
11	7	3	—	ITEM # 9
11	8	1	—	ITEM # 9

△4 FORM LEADS OF R1 (ITEM 6) TO FIT HOLE PATTERN.

△5 AFTER THIS TY-RAP, EVENLY SPACE REMAINING TY-RAPS (1 EVERY 4 INCHES) OVER LENGTH OF CONN WIRE BUNDLE.

△2 NOTE POLARITY MARKING ON PWB BEFORE INSTALLING CAPS C1 & C2.

△1 INSTALL RESISTOR R1 & SOLDER ALL WIRES TO PWB BEFORE INSTALLING CAPS C1 & C2.

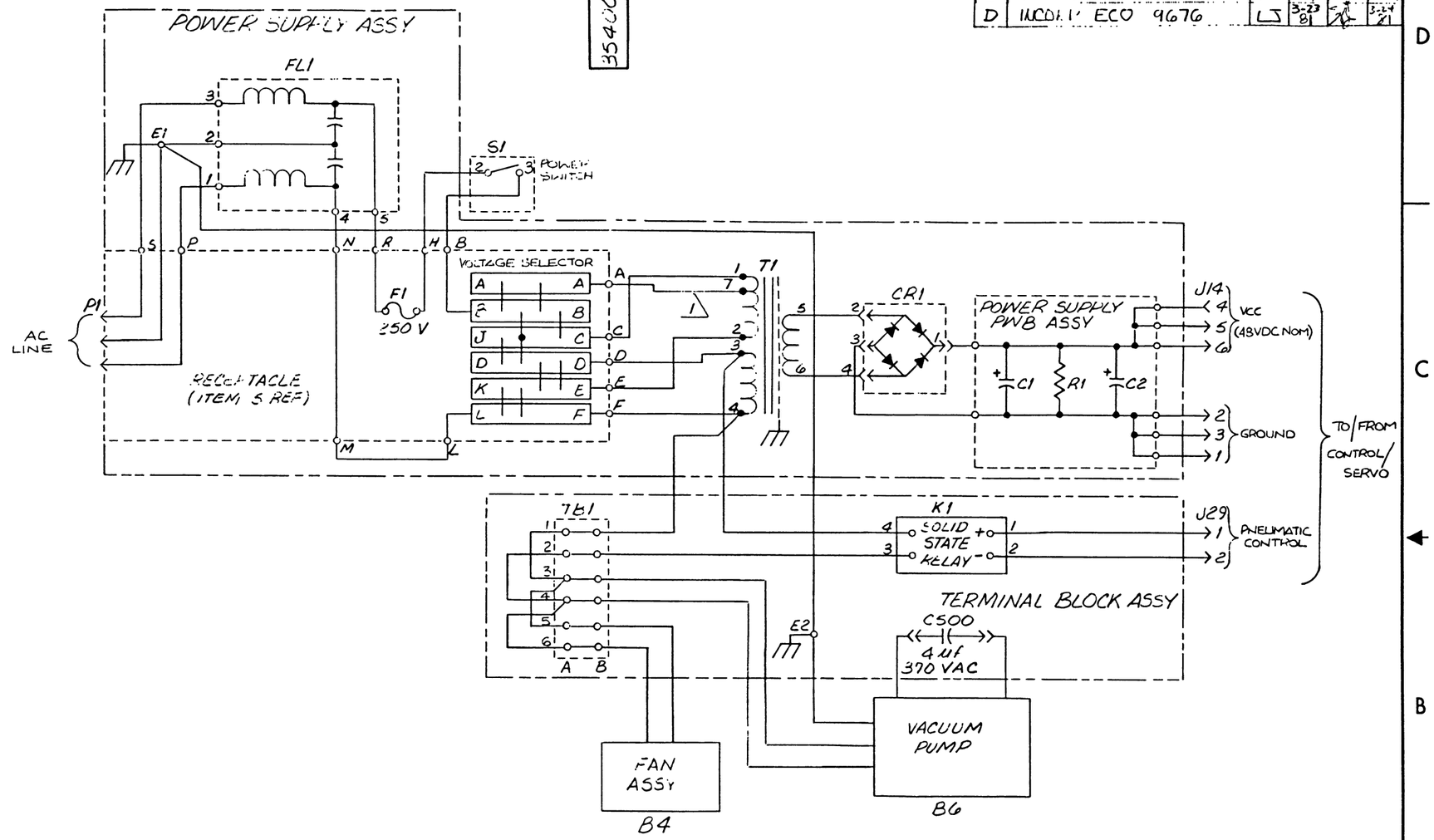
NOTES:

DRAWING NO. 154017-001
SHEET 1 OF 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± 5, DECIMALS .XX ± 5, .XXX ± 5, ANGLES ± 5	CONTRACT NO.		Cipher Data Products SAN DIEGO CALIF
	APPROVALS	DATE	
	DWN [illegible]	1-22-78	TITLE: PWB ASSY-POWER SUPPLY
	CHK [illegible]	3-6-78	
	MFG ENG [illegible]	3-17-78	
	QC [illegible]	3-17-78	SIZE C · CODE IDENT NO. 32274 · DRAWING NO. 154017-001 · REV E
	COG ENG [illegible]	5-1-78	
DO NOT SCALE DRAWING	PROD REL [illegible]	5-19-78	SCALE FULL · 900X · SHEET 12 OF 13

354000-998 REV D

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
A	ENGR. RELEASE	[illegible]	8-22-78	[illegible]	9/1/78
B	INCORP ECO 5240	RA	3-27-79	[illegible]	3-30-79
C	INCORP ECO 5501	[illegible]	[illegible]	[illegible]	6-18-79
D	INCORP ECO 9676	[illegible]	3-23-81	[illegible]	3-24-81



/1 USED ON TRANSFORMER 799008-210 ONLY.

NOTES:

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE. DECIMALS XX = ± XXX = ± ANGLES ±	APPROVALS	DATE
	DWN [illegible]	11/20/78
	CHK [illegible]	[illegible]
	MECH ENG JW Grafton	7/24/73
	ELEC ENG [illegible]	9.27.78
	MFG ENG [illegible]	[illegible]
	QC [illegible]	[illegible]
DO NOT SCALE DRAWING	DOC CHK [illegible]	10/4/79

Cipher Data Products SAN DIEGO CALIF

TITLE: SCHEMATIC DIAGRAM - MTT 900 POWER DISTR

SIZE	CODE IDENT NO.	DRAWING NO.	REV
C	32274	354000-998	D

SCALE NONE [illegible] SHEET 3 OF 3

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ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	154017-001	1	PWB ASSY-POWER SUPPLY	CIPHER DATA PROD			
2	799008-210	1	TRANSFORMER-POWER	SEE DRAWING			
3	754035-301	1	BASE-POWER SUPPLY	CIPHER DATA PROD			
4	799005-101	1	FILTER-EMI,5 AMP,K SERIES	CORCOM INC 5K1	FL1		
5	205198-010	1	RECEPTACLE-POWER	CORCOM INC 6J1			
6	202004-100	1	RECTIFIER BRIDGE	MOTOROLA SEMI. MDA-980-2	CR1		
7	210229-050	1	CLAMP,CABLE-3/8 BLACK	NOT ON FILE 8944			
8	210208-000	.4	GROMMET STRIP	NOT ON FILE MS21266-2N			
9	210408-008	.7	TUBING-SHRINK,BLK	ICO RALLY HIX-1/8			
10	210408-012	.5	TUBING-HEAT SHRINK,BLK	ICO RALLY H1X-3/16			
11	210132	1	GROMMET	SMITH,HERMAN H. 2146			
12	210229-523	8	TY-RAP-1/16 TO 5/8	ICO RALLY WRN 3 1/2			
13							
14	731006-800	1	LABEL-ASSY	CIPHER DATA PROD			
15							
16	210555-025	5	TERMINAL RING #6 SM PAT	HOLLINGSWORTH TERM. CO. R18818			
17	210555-033	4	TERMINAL,SLIP-ON,250 TAB	HOLLINGSWORTH TERM. CO. 805305F-T1			
18	208400-121	3.1	WIRE-STRD, 16AWG, IR, PVC	7134-1 CSA/UL			
19	208405-112	.7	WIRE-STED,18AWG,IRPVC,BLK	JUDD WIRE H10402			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
20	208105-111	.7	WIRE,STRD,18AWG,IRPVC,WHT	JUDD WIRE HH0402			
21	208105-014	1.0	WIRE-STRD,18GA,IR PVC GRN	ALPHA WIRE 7155-4			
22	208100-111	11.6	WIRE-STRD,16AWG,IRPVC,WHT	JUDD WIRE HH0405			
23	208100-112	2.7	WIRE-STRD,16AWG,IRPVC,BLK	JUDD WIRE HH0405			
24	208300-001	2	WIRE-STRD,14AWG,PVC,UL	ALPHA WIRE CORP. 3079-1 CSA/UL			
25	209999-000	11	MARKER,WIRE- 1-50	ANY ACCEPTABLE SOURCE VNM-0-49			
26	754053-301	1	LABEL-RECTIFIER ID	CIPHER DATA PROD			
27	213274-604	2	SCREW-PAN HEAD,PHILLIPS, 6-32X1/4	ANY ACCEPTABLE SOURCE			
28							
29	213271-606	5	SCREW-PAN HEAD PHIL, 6-32 X 3/8,CAD BLK,OR ZIN	ANY ACCEPTABLE SOURCE			
30	213271-608	1	SCREW-PAN HD PHIL 6-32 X 1/2,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
31	213092-612	1	SCREW-SKT HD CAP, 6-32 X 3/4,BLK ONLY	ANY ACCEPTABLE SOURCE			
32							
33							
34	213151-108	4	SCREW-FLAT HD PHIL,100 10-32X1/2	ANY ACCEPTABLE SOURCE			
35	207602-011	4	WASHER,SPLIT LOCK #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
36	207608-021	1	WASHER,FLAT,SMALL OD #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
37	207605-021	1	WASHER,FLAT #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
38							
39	207102-011	4	WASHER,SPLIT LOCK #10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
40	207104-021	4	WASHER, FLAT,#10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			
41	213098-610	2	SPEED NUT-6-32,F	NOT ON FILE C8094-632			
42	207607-051	2	NUT, HEX #6 6-32	ANY ACCEPTABLE SOURCE NUT #6 CAD.			
43	207101-081	4	NUT, HEX, RADIO PAT. #10 10-32	 NUT #10, CAD.			
44	210555-027	1	TERMINAL-RING, 22-16 AWG, #8	HOLLINGSWORTH TERM. CO. R1002S			
45	**********						
46							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754017-101	1	PWB-POWER SUPPLY	DIBBLE ELECTRONICS TYPE 1 OR 2			
2							
3	205066-500	1	CONNECTOR-6 POSN	MOLEX,INC. 03-09-1063			
4	205014	1	TERM-MALE,18-22AWG,.093 DIA, REEL	MOLEX,INC. 02-09-2116			
5	201174-158	2	CAP-ELECT,15800UF,75V	SEE DRAWING 91S75JF1582			
6	200123-300	1	RES-WW,3K,3.75W,5%	DALE ELEC. INC. CW-2B .1-9K	R1		
7	205013	5	TERM-FEM 18-22AWG.093DIA REEL	MOLEX,INC. 02-09-1116			
8	210229-523	8	TY-RAP-1/16 TO 5/8	ICO RALLY WRN 3 1/2			
9	210555-033	2	TERMINAL,SLIP-ON.250 TAB	HOLLINGSWORTH TERM. CO. 905305F-T1			
10	208405-111	16.7	WIRE,STRD,18AWG,IRPVC,WHT	JUDD WIRE HH0402			
11	208400-111	.10	WIRE-STRD,16AWG,IRPVC,WHT	JUDD WIRE HH0405			
12	209999-000	2	MARKER,WIRE- 1-50	ANY ACCEPTABLE SOURCE VMM-0-49			
13							
14							
15	210032-240	4	STDOFF-1/4 RND,1/2, 6-32,SWAGE	KEYSTONE 1604-3			
16	213271-106	4	SCREW-PAN HD PHIL, 10-32 X 3/8,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
ALT	213271-108		SCREW-PAN HEAD PHIL, 10-32 X 1/2,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
17							
18							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
19	207102-011	4	WASHER,SPLIT LOCK #10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			
20	207108-021	4	WASHER,FLAT, SMALL OD #10	ANY ACCEPTABLE SOURCE WASHER #10 CAD.			
21							

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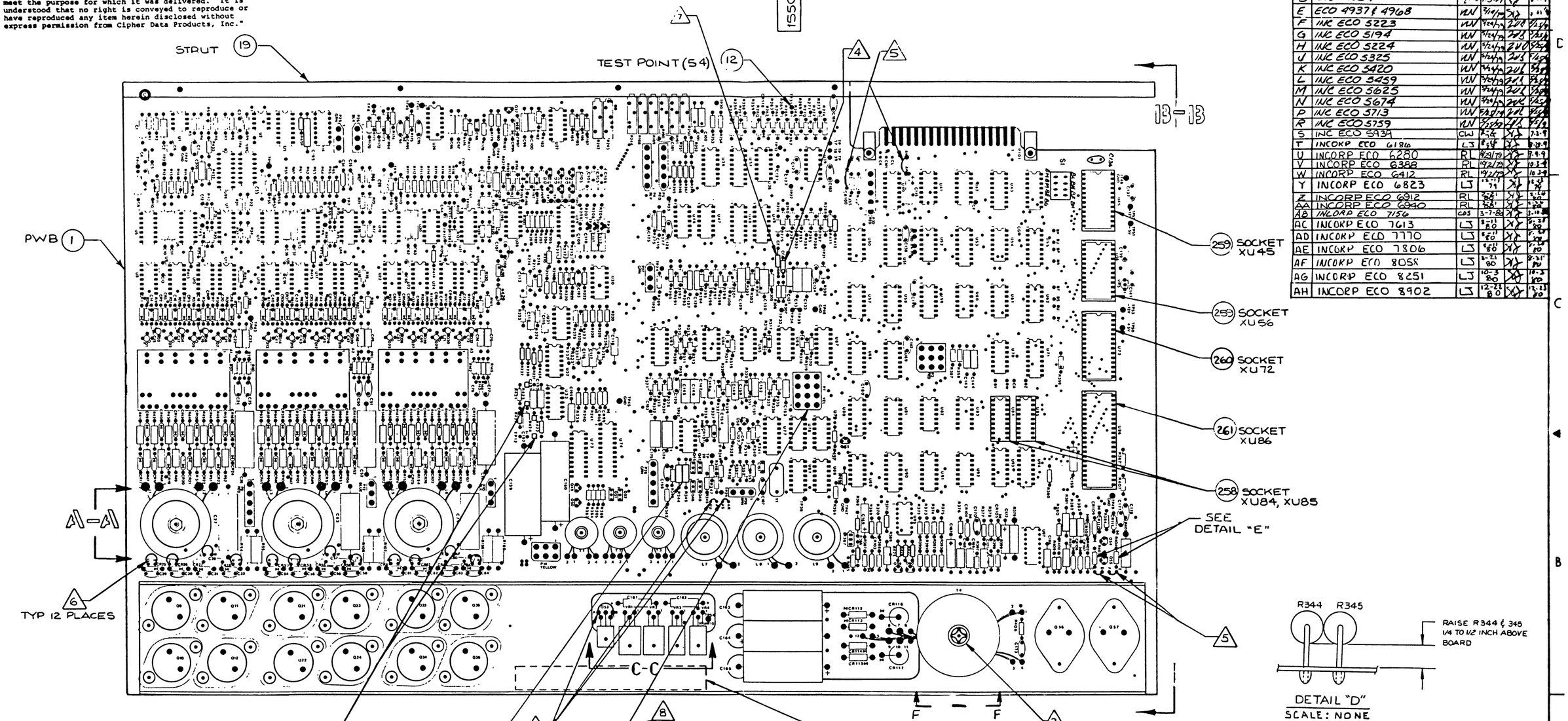
155012-001 REV AK

REVISION			
LTR	DESCRIPTION	DATE	APPROVAL
AJ	INCORP ECO 9682 LJ	3-16-81	3-20-81
AK	INCORP ECO 10120 LJ	5-13-81	5-14-81

REVISION				
LTR	DESCRIPTION	DWN	DATE	APP'D DATE
A	ENGR. RELEASE	PWB	3/29/78	4/4/78
B	ECO 9551	SGS	11-21-78	11-30-78
C	ECO'S 9681 & 9703	JM	11-17-78	12-4-78
D	ECO 9854	JM	1-3-79	1-4-79
E	ECO 9937 & 9968	MW	3/14/79	3-16-79
F	INC ECO 5223	MW	3/24/79	3/26/79
G	INC ECO 5194	MW	3/24/79	3/26/79
H	INC ECO 5224	MW	3/24/79	3/26/79
J	INC ECO 5325	MW	3/24/79	3/26/79
K	INC ECO 5420	MW	3/24/79	3/26/79
L	INC ECO 5459	MW	3/24/79	3/26/79
M	INC ECO 5625	MW	3/24/79	3/26/79
N	INC ECO 5674	MW	3/24/79	3/26/79
P	INC ECO 5713	MW	3/24/79	3/26/79
R	INC ECO 5739	MW	3/24/79	3/26/79
S	INC ECO 5934	CW	5-4	7-3-79
T	INCORP ECO 6186	LJ	8-14	8-28-79
U	INCORP ECO 6280	RL	9/21/79	9-19-79
V	INCORP ECO 6388	RL	9/21/79	10-3-79
W	INCORP ECO 6412	RL	9/21/79	10-3-79
Y	INCORP ECO 6823	LJ	12-11-79	12-31-79
Z	INCORP ECO 6912	RL	2-28-80	3-10-80
AA	INCORP ECO 6940	RL	3-4-80	3-24-80
AB	INCORP ECO 7156	CDS	3-7-80	3-18-80
AC	INCORP ECO 7613	LJ	5-15-80	5-27-80
AD	INCORP ECO 7770	LJ	6-6-80	6-20-80
AE	INCORP ECO 7806	LJ	6-20-80	7-1-80
AF	INCORP ECO 8058	LJ	8-21-80	9-21-80
AG	INCORP ECO 8251	LJ	10-3-80	10-15-80
AH	INCORP ECO 8902	LJ	12-31-80	1-13-81



3 PRIOR TO MOUNTING XFMRS REMOVE EXISTING HARDWARE (UPPER NYLON WASHER, LOWER NYLON WASHER, FLAT WASHER, SPLIT LOCKWASHER & HEX NUT). INSTALL THRU BOARD AND SECURE IN PLACE USING HARDWARE PREVIOUSLY REMOVED EXCEPT LOWER NYLONG WASHER. TYP 3 PLACES (T1-T3) SOLDER LEADS TO APPROPRIATE LANDS FOR T4 REPLACE SCREW (10-32 X 1 1/2) WITH ITEM 304 (10-32 X 1 3/4) REPLACE FLAT WASHER (#10) WITH ITEM 285 (#10). SOLDER LEADS AS ABOVE.

2 MARK ASSY PART NO & REV LTR ON ASSY LABEL (ITEM 37) LOCATED FARSIDE.

1 FOR SCHEMATIC SEE 355012-300.

NOTES:

7 INSTALL C194 AT LOCATION CD-CE.

6 INSTALL 7.0" LONG 30GA KYNAR INSULATED WIRE JUMPER, 12 PLACES AS SHOWN (TO BE REMOVED IN TEST).

5 INSTALL SLEEVED JUMPERS USING ITEM 299, 8 PLACES; AV-AW, BM-BN, CR300, C-D, F-E, AU-AT, AS-AR, A-B. USE ITEM 300 WHEN CROSSING LAND.

4 INSTALL R435 AT LOCATION CC-CB.

8 DO NOT MIX 205012 AND 205012-001 TERMINALS IN THE SAME CONNECTOR.

SHEET	REV	AK	AH
REV STATUS	SH	1	2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: DECIMALS .XX ± .X, .XXX ± .X; ANGLES ±

APPROVALS		DATE
DWN	[illegible]	7-[illegible]-78
CHK	R Abad	7-26-78
MECH ENG	A PARTON	11/2/78
ELEC ENG	[illegible]	11-6-78
MFG ENG	[illegible]	9/20/11
QC	[illegible]	11-2-78
DOC CTRL	[illegible]	11/2/78

DO NOT SCALE DRAWING

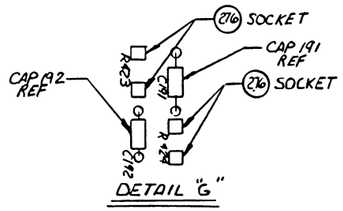
Cipher Data Products SAN DIEGO CALIF

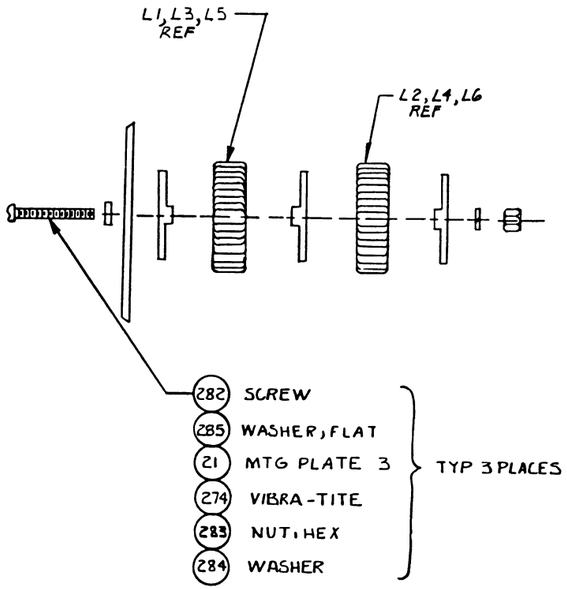
TITLE PWB ASSY— CONTROL SERVO 125 IPS

SIZE	CODE IDENT NO.	DRAWING NO	REV
D	32274	155012-001	AK

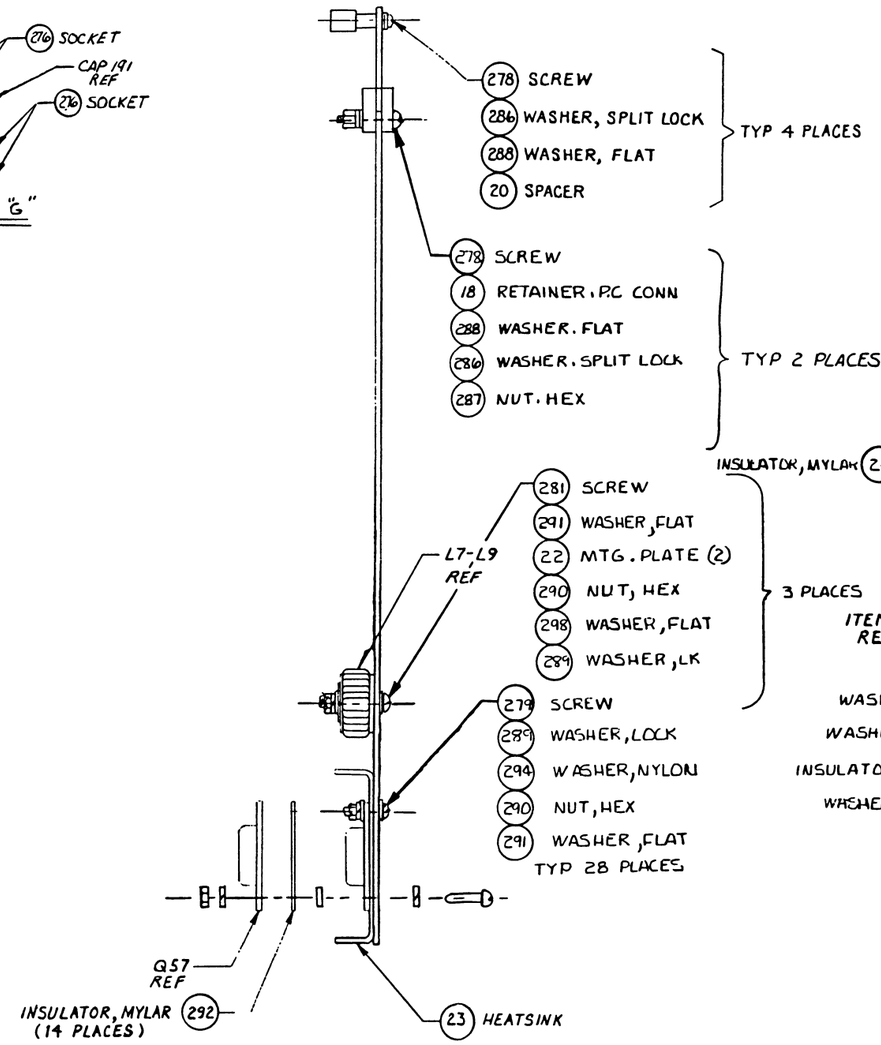
SCALE 1/1 SHEET 1 OF 2

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
–	–			KB	8-21-79
E	ECO 4937 & 4968	VLN	4/9/80	KB	4-29-80
P	INC ECO 5713	VLN	7-25-80	KB	8-4-80
R	INC ECO 5759	VLN	7-29-80	KB	8-4-80
T	INCORP ECO 6186	LJ	8-8-80	KB	8-28-80
V	INCORP ECO 6388	RL	10-2-80	KB	10-3-80
Z	INCORP ECO 6912	RL	1-20-81	KB	1-30-81
AA	INCORP ECO 6940	RL	2-20-81	KB	2-26-81
AC	INCORP ECO 7613	LJ	8-11-80	KB	8-21-80
AF	INCORP ECO 8058	LJ	8-21-80	KB	8-21-80
AG	INCORP ECO 8251	LJ	10-3-80	KB	10-3-80
AH	INCORP ECO 8902	LJ	12-22-80	HJ	12-29-80

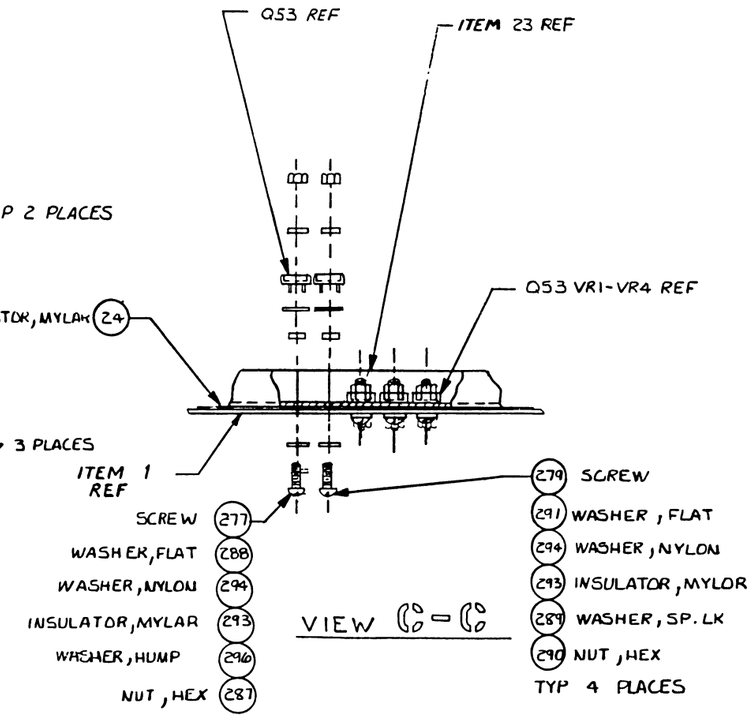




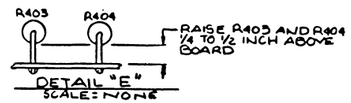
VIEW A1-A1



VIEW B1-B1



VIEW C1-C1



155012-001 REV AH

DRAWING NO 155012-001
SHEET 2 OF 2

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± — .XX ± — ± — .XXX ± —
DO NOT SCALE DRAWING

CONTRACT NO.
APPROVALS DATE
DRWN
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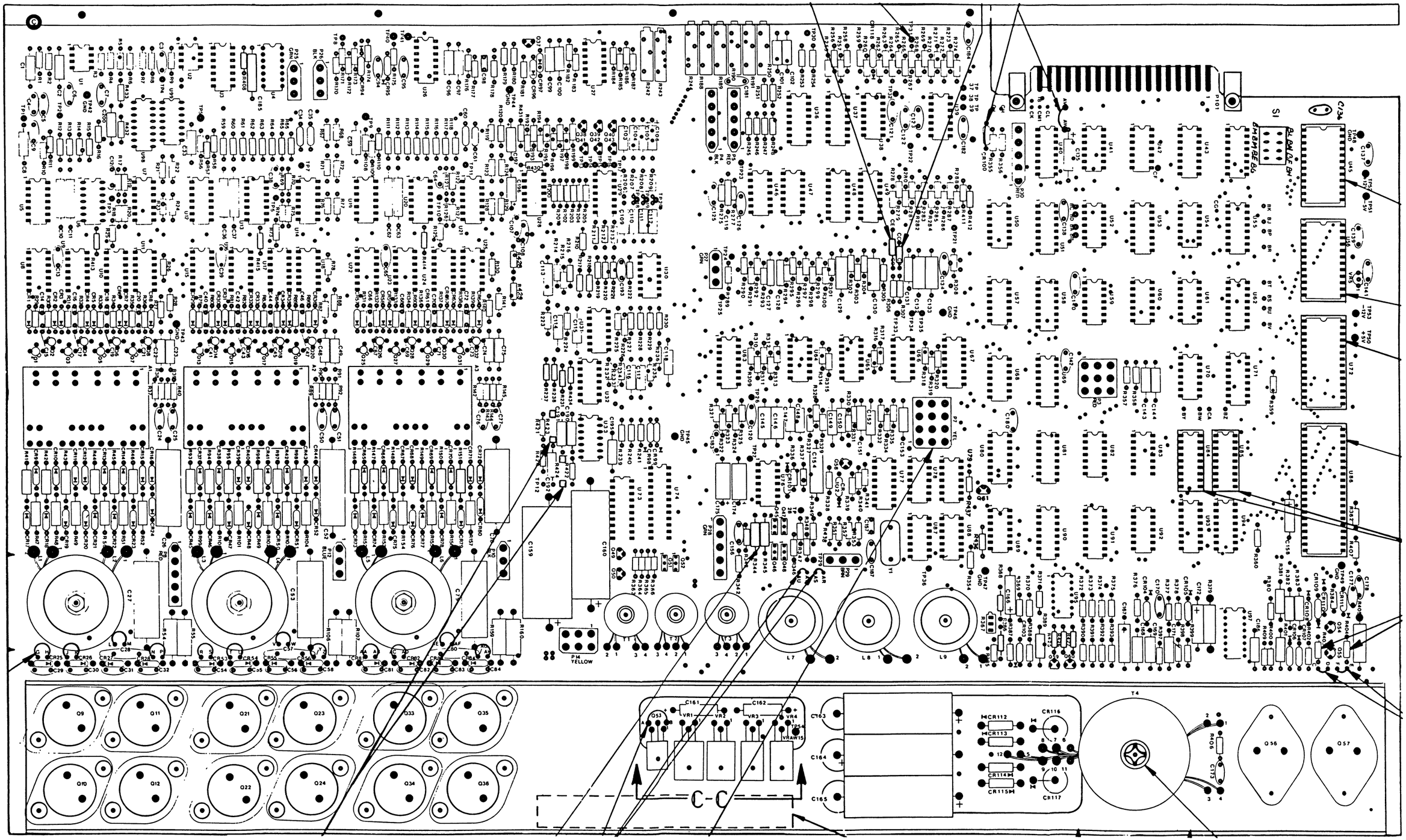
MFG MGR
QC
CONF ENGR
PROJ ENGR

Cipher Data Products SAN DIEGO CALIF

TITLE PWB ASSY- CONTROL SERVO 125 IPS

SIZE D | CODE IDENT NO. 32274 | DRAWING NO. 155012-001 | REV AH

SCALE 1/1 – 300 X | SHEET 2 OF 2


C/34
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EMBARBE BA
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TP48 GND
TP51 +5V
TP53 -12V
TP55 +5V
VR5
TP42 GND
TP47 GND
TP36
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P9 BLK
P10 BLK
P11 BLUE
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C-C
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T3
T4
L7
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Y1
VR1
VR2
VR3
VR4
VRAW15
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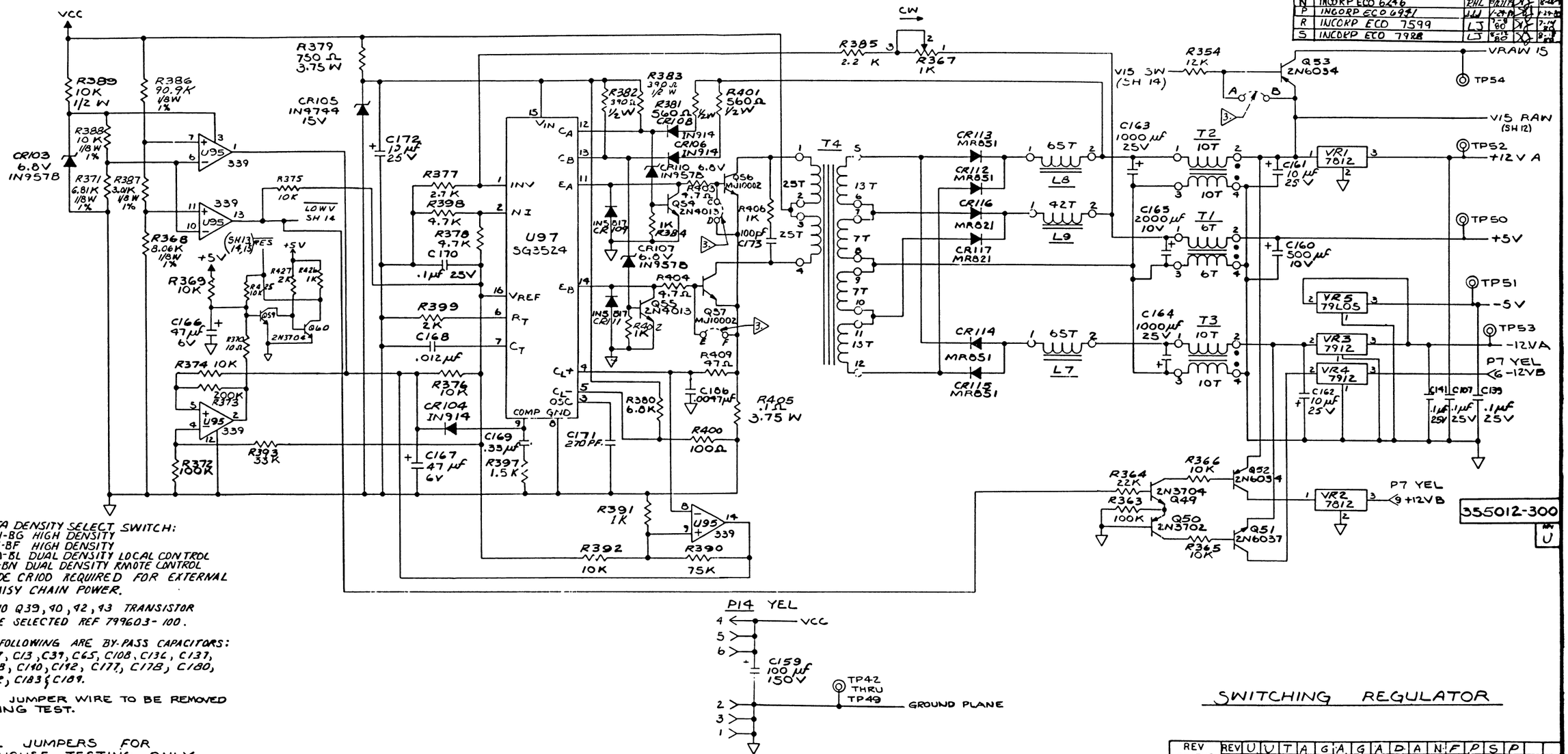
Q56
Q57

REVISION			
LTR	DESCRIPTION	DATE	APPROVAL
T	INCORP ECO 8903 LJ	12-22-80	12-22-80
U	INCORP ECO 9653 LJ	3-16-81	3-20-81

REVISION				
LTR	DESCRIPTION	DWN	DATE	APVD DATE
A	ENGR. RELEASE	PJB	7/20/78	JC 7/20/78
B	INC ECO 4682 & 4704	[illegible]	11-17-78	[illegible]
C	INC ECO 4769	WN	4/17/79	[illegible]
D	INC ECO 5195	WN	7/13/79	[illegible]
E	INC ECO 5254	WN	7/13/79	[illegible]
F	INC ECO 5255	WN	7/13/79	[illegible]
G	INC ECO 5257	WN	7/13/79	[illegible]
H	INC ECO 5326	WN	7/13/79	[illegible]
J	INC ECO 5256	WN	7/13/79	[illegible]
K	INC ECO 5626	WN	7/13/79	[illegible]
L	INC ECO 5714	WN	7/13/79	[illegible]
M	INC ECO 6012	CW	11/7/79	[illegible]
N	INCORP ECO 6246	RHL	3/21/80	[illegible]
P	INCORP ECO 6991	WN	7-29-80	[illegible]
R	INCORP ECO 7599	LJ	5-8-80	[illegible]
S	INCORP ECO 7928	LJ	8-6-80	[illegible]



7. DATA DENSITY SELECT SWITCH:
   BH-BG HIGH DENSITY
   BE-BF HIGH DENSITY
   BM-BL DUAL DENSITY LOCAL CONTROL
   BM-BN DUAL DENSITY RMOTE CONTROL
6. DIODE CR100 REQUIRED FOR EXTERNAL DAISY CHAIN POWER.
5. PG.10 Q39, 40, 42, 43 TRANSISTOR ARE SELECTED REF 799603-100.
4. THE FOLLOWING ARE BY-PASS CAPACITORS: C4-7, C13, C39, C65, C108, C136, C137, C138, C140, C192, C177, C178, C180, C182, C183 & C189.
3. THIS JUMPER WIRE TO BE REMOVED DURING TEST.
2. ALL JUMPERS FOR IN-HOUSE TESTING ONLY.
1. ALL RESISTORS ARE 1/4W, 5% CARBON COMP.

NOTES: UNLESS OTHERWISE SPECIFIED

SWITCHING REGULATOR

355012-300 REV U

REV STATUS	REV	U	U	T	A	G	A	G	A	D	A	N	F	P	S	P		
	SH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± — .XX ± — .XXX ± —

CONTRACT NO.

APPROVALS	DATE
DWN [illegible]	7-20-78
CHK [illegible]	9-14-78
ENG APVL [illegible]	9-29-78
QC [illegible]	11-2-78
COMMERCIAL [illegible]	11-6-78
PRODUCTION [illegible]	11-8-78

DO NOT SCALE DRAWING

Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC — PWB, CONTROL/SERVO

SIZE D | CODE IDENT NO. 32274 | DRAWING NO. 355012-300 | REV U

SCALE — | 900X | SHEET 1 OF 15

DRAWING NO. 355012-300
SHEET 1 OF 15

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE

SEE SH 1 FOR REVISION

(SH 19) REV CLAMP — R339 4.7K — Q58 2N2222 — CR102 IN914 — C154 22µF 15V — +12V

R341 470K — IH5012 U77 — -12V

+12V REWUP (SH 19) — R340 75K — U77 — IH5012

(SH 19) REWDN

U76 — 4136 — R338 2.4K — CR101 IN914 — R336 10.0K 1/8 W 1% — R337 4.99K 1/8 W 1% — TP27 — RAMP (SH 11,12)

-12VB

+12VA — R240 2.21K 1/8W 1% — R241 2.21K 1/8 W 1% — R243 20K — R244 20K — CW

RNFWD (SH 15) — CR99 IN914

RNREV (SH 15) — CR98 IN914

R239 2.49K 1/8 W 1% — R237 2.49K 1/8 W 1% — U32 — 4136

R238 2.49K 1/8W 1% — R231 47K — C117 220Pf 300V — R235 220K

R234 910Ω — R232 12K — R233 10K — C116 .15µf 50V — +12VB — R434 39K — U32 — 4136

CW — R242 20K — RAMPING (SH 12)

R236 33.2K 1% 1/8W — C118 1µF 50V, 3% — R230 30.9K 1% 1/8W — U31 — 4136

R225 80.6K 1%, 1/8W

R227 80.6K 1%, 1/8W

R226 12.1K 1%, 1/8W

R228 30.1K 1/8 W 1%

R229 20.0K 1/8 W 1%

C115 1µF 50V, 3% — U31 — 4136 — R224 80.6K 1%, 1/8W — C114 1µF 50V, 3% +12VB — U31 — 4136 — -12VB

R223 33.2K 1%, 1/8W — C113 1µF 50V, 3% — R214 174K 1%, 1/8W — U31 — 4136

R216 80.6K 1%, 1/8W — R215 71.5K 1%, 1/8W — U31 — 4136

R217 20.0K 1/8 W 1%

TP33 — +XOFF (SH 11,12)

R222 10.0K 1/8W, 1% — C193 .µf, 10V — R221 10.0K 1/8 W 1% — U30 — 4136 — -XOFF (SH 11)

TP21 — R218 15.0K 1% 1/8 W — U30 — 4136 — + IOFF (SH 11)

R219 10.0K 1/8 W 1%

R220 10.0K 1/8 W 1% — +12VB — U30 — 4136 — -12VB — - IOFF (SH 11)

355012-300 REV U

RAMP REWIND AND REEL OFFSET

DRAWING NO. 355012-300 SHEET 2 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ±1/64 DECIMALS .XX ±.02 .XXX ±.005 ANGLES ±2°

CONTRACT NO. — APPROVALS — DATE — DWN. RVB 9-26-78 — CHK. RC 9-26-78 — ENG APPR. bgl 9-29-78 — QC — CODE IDENT NO. — PROD. SUPT.

DO NOT SCALE DRAWING

Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC — PWB CONTROL/SERVO

SIZE D — CODE IDENT NO. 32274 — DRAWING NO. 355012-300 — REV U

SCALE — — 900X — SHEET 2 OF 15

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH 1 FOR REVISION				

CAPSTN D (SH 11)

TP1

R10 47K

C9 300pf 300V

R16 10K

C8 .01 µf 50 V

+12V

-12V

U5 9636

R11 10K

U5 9636

+5V

R20 4.7K

R19 7.5K

U7 339

U11 74LS11

+5V

R18 4.7K

R17 7.5 K

U7 339

U11 74LS11

ENABLE 4 (SH 19)

C200 .04µf

R432 15K

+5V

LS123 U98

+5V

$\overline{I_{L4}}$ (SH 4)

U11 74LS11

f- (SH 5,7)

f+ (SH 5,7)

R433 4.7K

+5V

R408 15Ω

C105 22 µf 6.3V

IC/T01 (SH 13)

U4 LS74

R9 4.7K

R4 3.0K

R7 470Ω

R6 470Ω

R3 3.0K

-12V

+12V

R8 220Ω

C3 680pf 300V

R5 47K

C2 .022µf 50V

U2 318

TP4

U1 741

R1 1K

R2 2K

C1 .022 µf, 50V

U3 7400

U3 7400

U3 7400

U3 7400

U3 7400

U3 7400

BIA (SH 5,7)

BZA (SH 5,7)

BIB (SH 5,7)

BZB (SH 5,7)

+5V

U9 560Ω

VRAW 15

A1

C17 .0012 µf

R31 560Ω

U8 7402

Q3 2N4014

CR3 IN914

C24 .1µf 25V

R39 4.7Ω

T4-A

C14 .0012 µf

R30 560Ω

U8 7402

Q2 2N4014

CR2 IN914

C16 .0012µf

R32 560Ω

U10 7400

Q4 2N4014

CR4 IN914

R40 4.7Ω

T2-A

C15 .0012µf

R29 560Ω

U10 7400

Q1 2N4014

CR1 IN914

C21 .0012µf

R35 560Ω

U10 7400

Q7 2N4014

CR7 IN914

C25 .1µf 25V

R38 4.7Ω

T1-A

C18 .0012µf

R34 560Ω

U10 7400

Q6 2N4014

CR6 IN914

C20 .0012µf

R36 560Ω

U8 7402

Q8 2N4014

CR8 IN914

R37 4.7Ω

T3-A

C19 .0012µf

R33 560Ω

U8 7402

Q5 2N4014

CR5 IN914

355012-300 REV T

CAPSTAN SERVO

DRAWING NO 355012-300 SHEET 3 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES

CONTRACT NO.

APPROVALS DATE

DWN PKB 9-26-78

CHK RCA 9-26-78

MFG ENG HH 9-26-78

QC

COG ENG

PROG MGR

DO NOT SCALE DRAWING

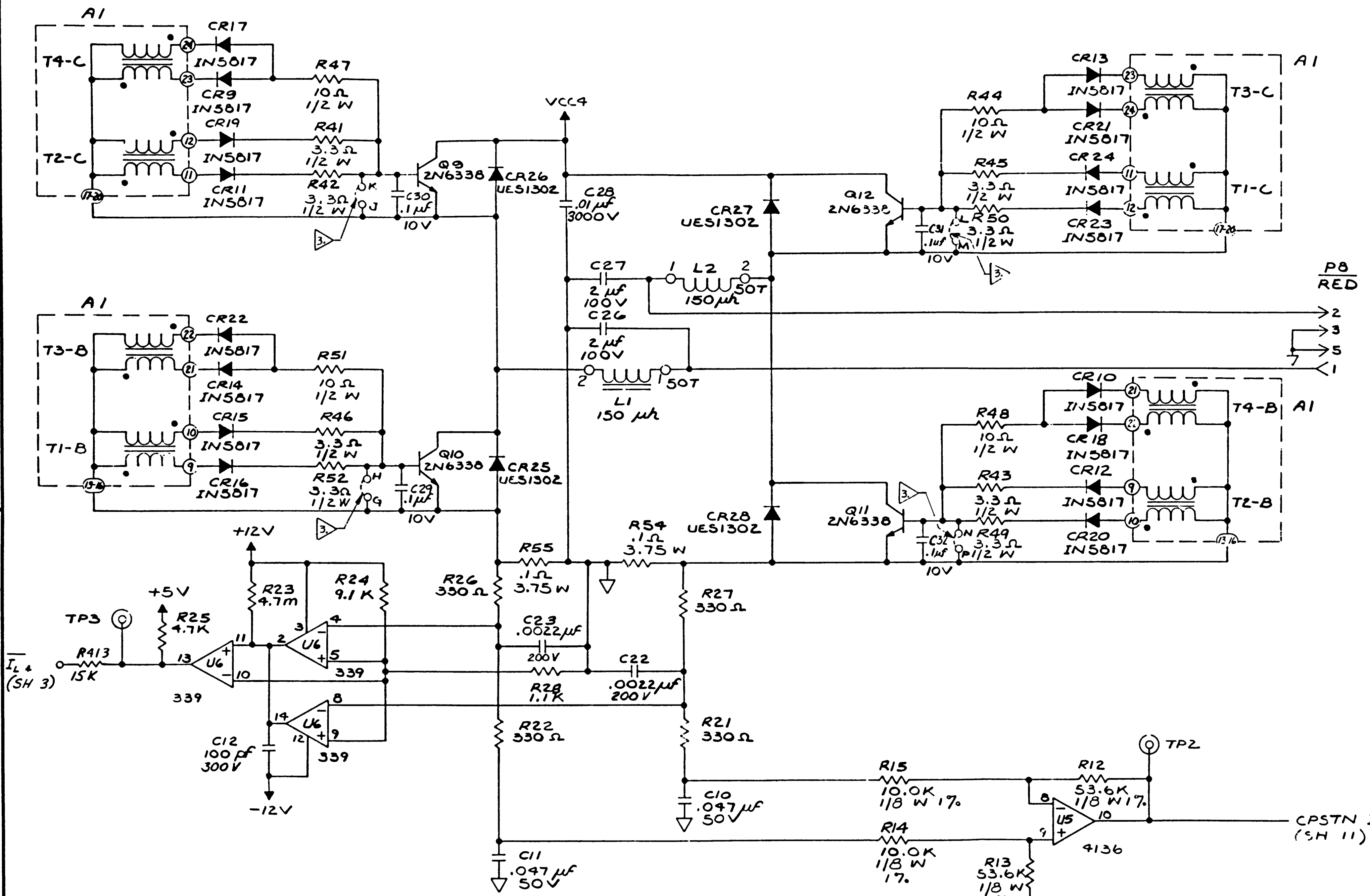
Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC—PWB, CONTROL/SERVO

SIZE D | CODE IDENT NO. 32274 | DRAWING NO. 355012-300 | REV T

SCALE — | 900X | SHEET 3 OF 15

REVISION
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH 1 FOR REVISION				

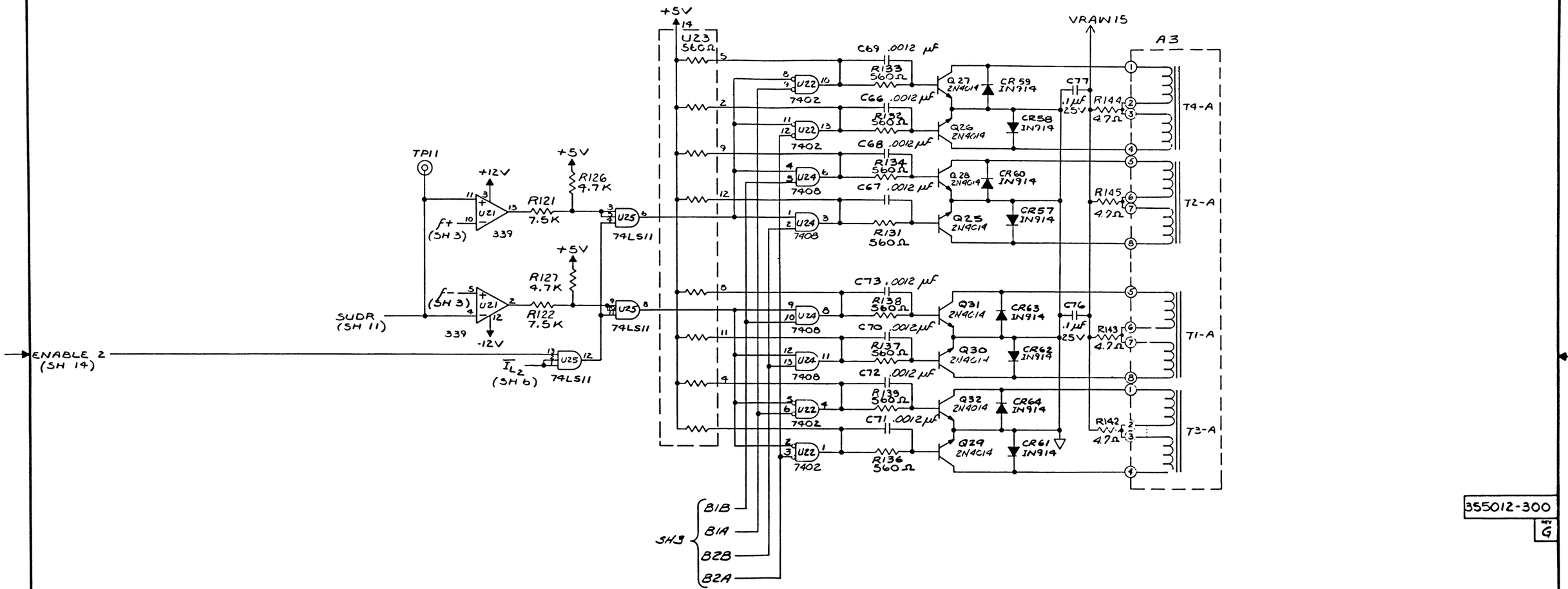


355012-300
REV A

CAPSTAN SERVO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS XX ± XXX ± ANGLES ±	CONTRACT NO.		Cipher Data Products SAN DIEGO CALIF
	APPROVALS	DATE	
	DWN PVB	9-26-78	TITLE SCHEMATIC—PWB, CONTROL / SERVO
	CHK	9-26-78	
	MFG ENG	9-29-78	
	QC		SIZE D · CODE IDENT NO. 32274 · DRAWING NO. 355012-300 · REV A
	CDG ENG		
DO NOT SCALE DRAWING	PROD REL		SCALE — · 900X · SHEET 4 OF 15

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
SEE SH1 FOR REVISION					



355012-300
REV G

SUPPLY REEL SERVO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± — .XX ± — .XXX ± —	CONTRACT NO.	Cipher Data Products SAN DIEGO CALIF	
	APPROVALS / DATE	TITLE: SCHEMATIC — PWB, CONTROL / SERVO	
	DWN PWB 9-26-78		
	CHK [illegible] 9-26-78		
	MFG ENG [illegible] 9-26-78		
	QC	SIZE D	CODE IDENT NO. 32274
	CDS REG	DRAWING NO. 355012-300	REV G
DO NOT SCALE DRAWING	ECO NO.	SCALE —	900X SHEET 5 OF 15

DRAWING NO. 355012-300
SHEET 5 OF

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE

SEE SH. 1 FOR REVISION

A3 CR73 IN5017 T4-C R152 10Ω 1/2W CR65 IN5017 CR75 T2-C R146 3.3Ω 1/2W CR67 IN5017 R147 3.3Ω 1/2W AD C82 .1μf 10V Q33 2N6338 CR82 UES1302

VCC4

C80 .01μf 3000V

CR83 UES1302

Q36 2N6338

A3 CR69 IN5017 T3-C R149 10Ω 1/2W CR77 IN5017 R150 3.3Ω 1/2W CR80 IN5017 T1-C C83 1μf AE AF R155 3.3Ω 1/2W CR79 IN5017 10V

C79 2μf 100V

L6 150 μh 50T

C78 2μf 100V

L5 150 μh 50T

P10 BLK + 1 − 2

A3 CR78 IN5017 T3-B R156 10Ω 1/2W CR70 IN5017 CR71 T1-B R151 3.3Ω 1/2W CR72 IN5017 R157 3.3Ω 1/2W AD C81 .1μf AA 10V Q34 2N6338 CR81 UES1302

A3 CR66 IN5017 T4-B R153 10Ω 1/2W CR74 IN5017 R148 3.3Ω 1/2W CR68 IN5017 T2-B C84 1μf AG AH R154 3.3Ω 1/2W CR76 IN5017 10V Q35 2N6338 CR84 UES1302

+12V

R160 .1Ω 3.75W R159 .1Ω 3.75W R140 330Ω

TP9

R129 12K R130 330Ω C75 .0022μf 200V C74 .0022μf 200V R141 1.1K R123 330Ω

R120 20K R118 100K 1/8W 1% R115 10.0K 1/8W 1% R109 75K R108 750K

C61 .10μf 100V 20% C60 .10μf 100V 20% C59 .22μf 50V

R119 20K R117 100K 1/8W 1% R116 10.0K 1/8W 1% R110 60K

U19 4136

SUV (SH 11 & 12)

TP10 +5V R128 4.7m R125 4.7K R414 15K $\overline{IL_2}$ (SH 5)

U20 339

C64 100pf 300V

-12V

C62 .047μf 50V

R114 10.0K 1/8W 1% R111 53.6K 1/8W 1%

SUI (SH 11)

C63 .047μf 50V R113 10.0K 1/8W 1% R112 53.6K 1/8W 1%

355012-300 REV A

SUPPLY REEL SERVO

DRAWING NO. 355012-300 SHEET 6 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES .XX ±.02 .XXX ±.005 DO NOT SCALE DRAWING

CONTRACT NO. APPROVALS DATE DWN TPW 9-20-78 CHK RCB 9-26-78 MFG ENG 9-27-78 QC COG ENG PROD REL

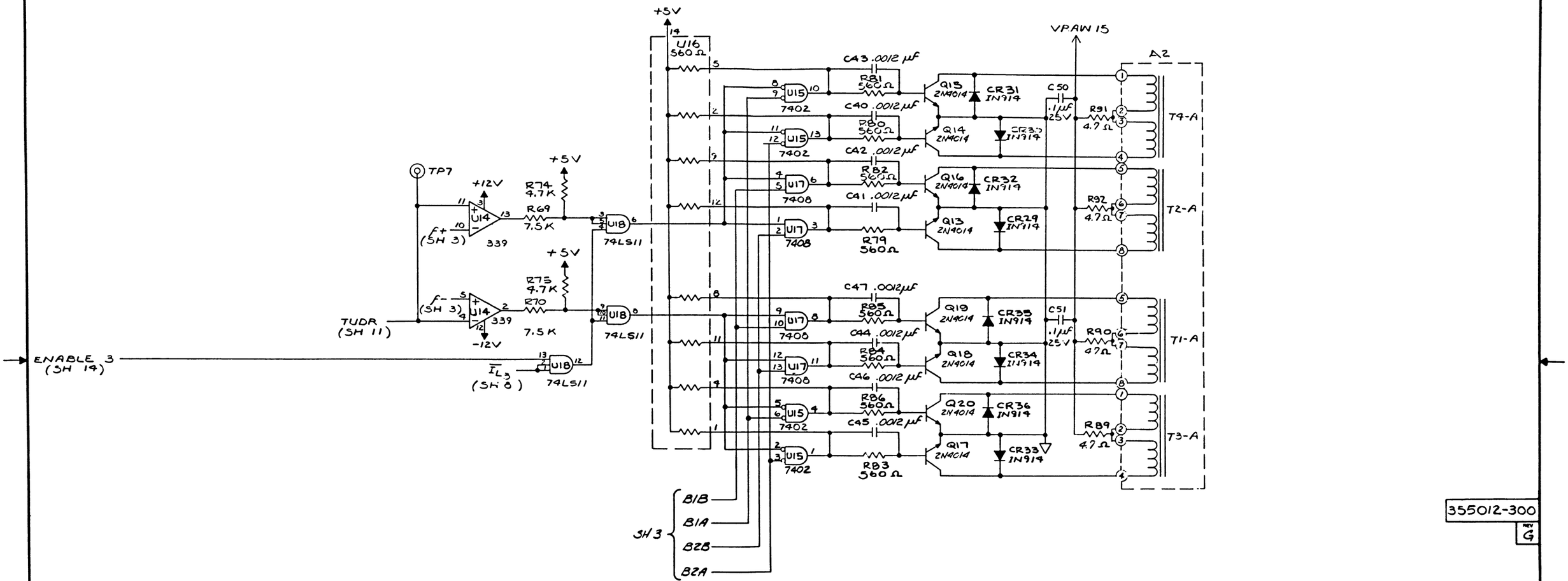
Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC - PWB, CONTROL / SERVO

SIZE D CODE IDENT NO. 32274 DRAWING NO. 355012-300 REV A

SCALE — 900X SHEET 6 OF 15

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH 1 FOR REVISION				



355012-300 REV G

TAKE-UP REEL SERVO

DRAWING NO. 355012-300
SHEET 7 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES .X ±.1 .XX ±.01 .XXX ±.005	CONTRACT NO.	Cipher Data Products SAN DIEGO CALIF	
	APPROVALS / DATE	TITLE	
	DRAWN R.V.B. 9-6-78	SCHEMATIC — PWB, CONTROL/SERVO	
	CHK Richard 9-14-78		
	MFG ENG JH 9-26-78	SIZE D / CODE IDENT NO. 32274 / DRAWING NO. 355012-300 / REV G	
DO NOT SCALE DRAWING	QC / COG ENG / PROD REL	SCALE — / 900X / SHEET 7 OF 15	

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH.1 FOR REVISION				

A2 CR45 IN5817 R99 10Ω 1/2W T4-C
CR37 IN5817
CR47 IN5817 R93 3.3Ω 1/2W T2-C
CR39 IN5817
R94 3.3Ω 1/2W .5U T
C35 .1μf 10V
Q21 2N6338
CR54 UES1302
VCC4
C57 .01μf 3000V
CR55 UES1302
Q24 2N6338
C56 .1μf 10V
R102 3.3Ω 1/2W
CR51 IN5817 R97 3.3Ω 1/2W CR52 IN5817 T1-C
R96 10Ω 1/2W CR49 IN5817 T3-C A2
C53 2μf 100V
150μh L4 50T
P12 BLUE
C52 2μf 100V
L3 150μh 50T
A2 CR50 IN5017 R103 10Ω 1/2W T3-B
CR42 IN5817
CR43 IN5017 R98 3.3Ω 1/2W T1-B
CR44 IN5017
R104 3.3Ω 1/2W .5R C54 .1μf 10V
Q22 2N6338
CR53 UES1302
CR38 IN5817 R100 10Ω 1/2W T4-B A2
CR46 IN5817
CR40 IN5817 R95 3.3Ω 1/2W T2-B
CR48 IN5817
CR56 UES1302
Q23 2N6338
C58 .1μf 10V
R101 3.3Ω 1/2W
TP5
+12V
R107 .1Ω 3.75W
R106 .1Ω 3.75W
R57 75K
R56 750K
R76 9.7m
R77 11K
R78 330Ω
C49 .0022μf 200V
R88 1.1K
C48 .0022μf 200V
R87 330Ω
R66 100K 1/8W 1%
R63 10.0K 1/8W 1%
R68 20K
C35 .10μf 100V 20%
C34 10μf 100V 20%
U12 4136
R58 60K
C33 .22μf 50V
TUV (SH11&12)
+5V
TP6
R73 4.7K
R415 SH 7 15K
U13 339
C38 100pf 300V
R72 330Ω
R71 330Ω
R67 20K
R65 100K 1/8W 1%
R64 10.0K 1/8W 1%
-12V
C36 .047μf 50V
R62 10.0K 1/8W 1%
R59 53.6K 1/8W 1%
R61 10.0K 1/8W 1%
R60 53.6K 1/8W 1%
C37 .047μf 50V
TUI (SH11)

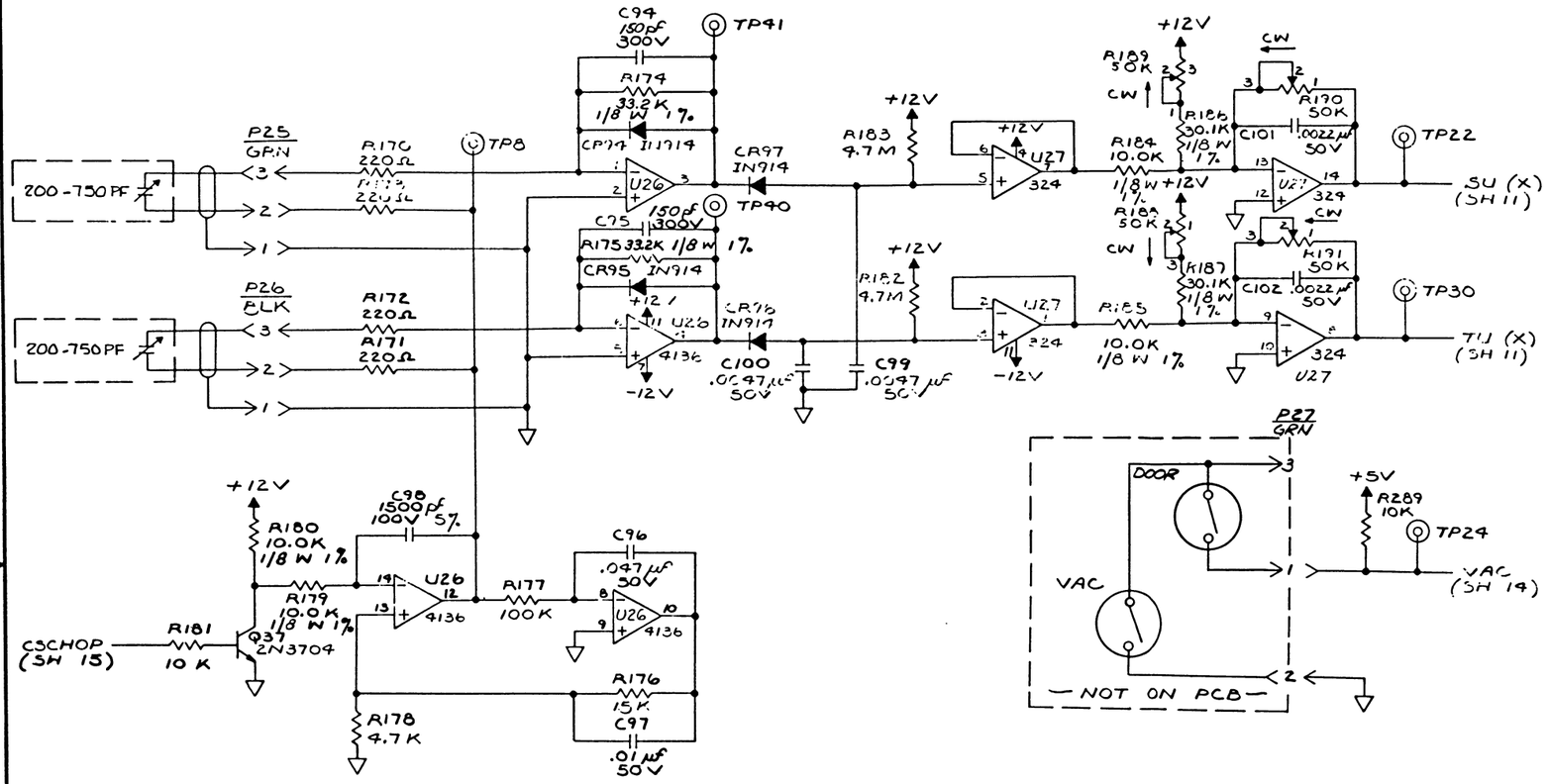
355012-300 REV A

TAKE-UP REEL SERVO

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES .XX ±.1 .XXX ±.2	CONTRACT NO.		Cipher Data Products SAN DIEGO CALIF	
DO NOT SCALE DRAWING	APPROVALS	DATE	TITLE	SCHEMATIC — PWB, CONTROL / SERVO
	DWN PVB	9-26-78		
	CHK [illegible]	9-26-78		
	MFG ENG [illegible]	9-26-78		
	QC		SIZE D	CODE IDENT NO. 32274
	COG ENG		DRAWING NO. 355012-300	REV A
	ENGG REL		SCALE —	900X SHEET 8 OF 15

DRAWING NO. 355012-300
SHEET 8 OF

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH. 1 FOR REVISION				



355012-300
REV D

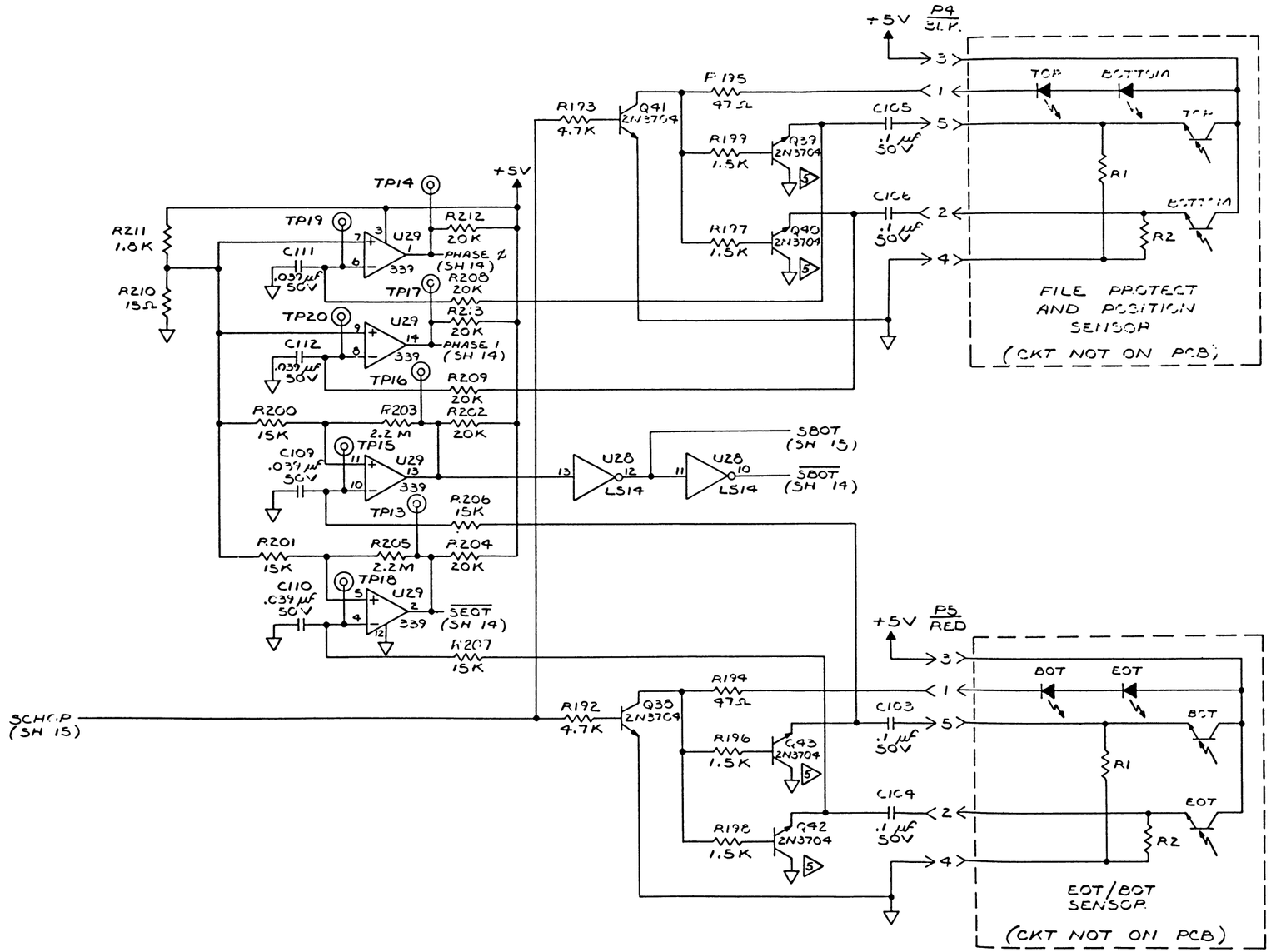
TRANSDUCER CONVERTER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± .XXX ±	CONTRACT NO.	Cipher Data Products SAN DIEGO CALIF	
	APPROVALS / DWN. PVB / CHK / MFG ENG / QC / COG ENG / ENGG REL	DATE 9/20/78 9-4-78 9-22-78	TITLE SCHEMATIC — PWB, CONTROL/SERVO
DO NOT SCALE DRAWING		SIZE D	CODE IDENT NO. 32274
		DRAWING NO. 355012-300	REV D
		SCALE — 900X	SHEET 9 OF 15

DRAWING NO. 355012-300
SHEET 9 OF

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE

SEE SH. 1 FOR REVISION



355012-300
REV A

FILE PROTECT AND
EOT/BOT SENSORS

DRAWING NO. 355012-300
SHEET 10 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± — .XX ± — .XXX ± —	CONTRACT NO.			
	APPROVALS	DATE	Cipher Data Products SAN DIEGO CALIF	
	DWN PKB	9-10-79	TITLE SCHEMATIC — PWB, CONTROL/SERVO	
	CHK [illegible]	9-16-79		
	MFG ENG	9-19		
	QC		SIZE D	CODE IDENT NO. 32274
	COG SUP		DRAWING NO. 355012-300	REV A
DO NOT SCALE DRAWING	PROD REL		SCALE —	900X SHEET 10 OF 15

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
A	ENGR. RELEASE	PVB	9/21/78	JW	9/25/78
N	INCORP. ECO 6246	RHL	9/20/84	JW	9-20-84

CAPSTN I (SH 9)
RAMP (SH 2)
PS RED
TACH -4
TACH +5
SHIELD 3
TP12
R420 30.1K 1%
C195 .033μF
R421 30.1K 1%
U33 4136
C190 .0091μF 50V 1%
R423 1.47K
C191 .0091μF 50V, 5%
R422 1.96K
C192 .018μF 50V, 5%
R424 6.34K
+12V
-12V
R247 20K
R248 12.7K ¼W, 1%
R290 10K ¼W 1%
TP23
R277 390K
C126 220pF 300V
R250 50K
C181 1μF 25V
R251 330K
U49 IH5012
R279 47K
RMP ERR (SH 12)
S1 (SH 15)
C121 .1μF 25V
R246 20K
R275 15K
C119 .012μF 50V
C125 470pF 300V
U46 4136
R291 4.3K
R293 4.3K
C127 .0047μF 50V
R292 2K
C128 .039μF 50V
U46 4136
CPSTN D (SH 3)
C150 .0022μF 200V

-IOFF (SH 2)
-XOFF (SH 2)
TP26
R294 36K
R296 220K
R325 20m
C120 100pF 300V
R322 33K
R321 75K
C146 .33μF 50V
U63 IH5012
S2 (SH 15)
R329 470K
R323 470K
C145 .33μF 50V
TP25
TUERR (SH 12)
R313 100K
R314 68K
U64 9136
R295 15K
R411 270K
+12V
U49 IH5012
S5 (SH 15)
R330 10K
C149 .33μF 50V
U45 9136
R329 4.3K
C147 .15μF 50V
R327 4.3K
R328 2K
C148 .022μF 50V
U64 9136
TUDR (SH 7)

TU (X) (SH 9)
R297 220K
U64 9136
+12V
R312 150K
R309 33K
U63 IH5012
S3 (SH 15)
S12 (SH 14)
R310 75K
U63 IH5012
S4 (SH 15)

TUV (SH 8 & 12)
TUI (SH 8)
R300 10K
R301 5.1K
R315 220K
R298 10K
U65 9136
R299 220K
C129 .068μF 50V
U63 IH5012
S6 (SH 15)
TP35

+IOFF (SH 2)
+XOFF (SH 2)
R288 33K
R435 150K 1%
CC
CB
R307 470K 1%
C194 CD .033μF 10%
CE
R308 20m
C134 100pF 300V
R281 470K
R282 470K
C133 .33μF 50V
R289 27K
R287 51K
C132 .47μF 100V 5%
U67 IH5012
S7 (SH 15)
TP34
SUERR (SH 12)
R318 100K
R317 75K
U66 9136
R280 15K
R412 270K
+12V
U47 IH5012
S10 (SH 15)
C151 .0022μF 200V
R331 10K
C152 .33μF 50V
U45 9136
R332 4.3K
C131 .15μF 50V
R335 9.3K
C153 .022μF 50V
R334 2K
+12V
-12V
U66 9136
SUDR (SH 5)

SU (X) (SH 9)
R306 301K 1%
U66 10 9136
U66 4 9136
R319 33K
U67 IH5012
S8 (SH 15)
R320 75K
U67 IH5012
S9 (SH 15)
S13 (SH 14)

SUV (SH 6)
SUI (SH 6)
R303 10K
R304 5.1K
R316 220K
R302 10K
U65 10 9136
R305 220K
C138 .068μF 50V
R311 33K
U67 IH5012
S11 (SH 15)

355012-300
REV N

DRAWING NO. 355012-300
SHEET 11 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES .XX ± — .XXX ± —
DO NOT SCALE DRAWING

CONTRACT NO.
APPROVALS DATE
DWN PVB 9-20-78
CHK RCA 9-14-78
MFG ENG 9-26-78
QC
CDS ENG
PROD REL

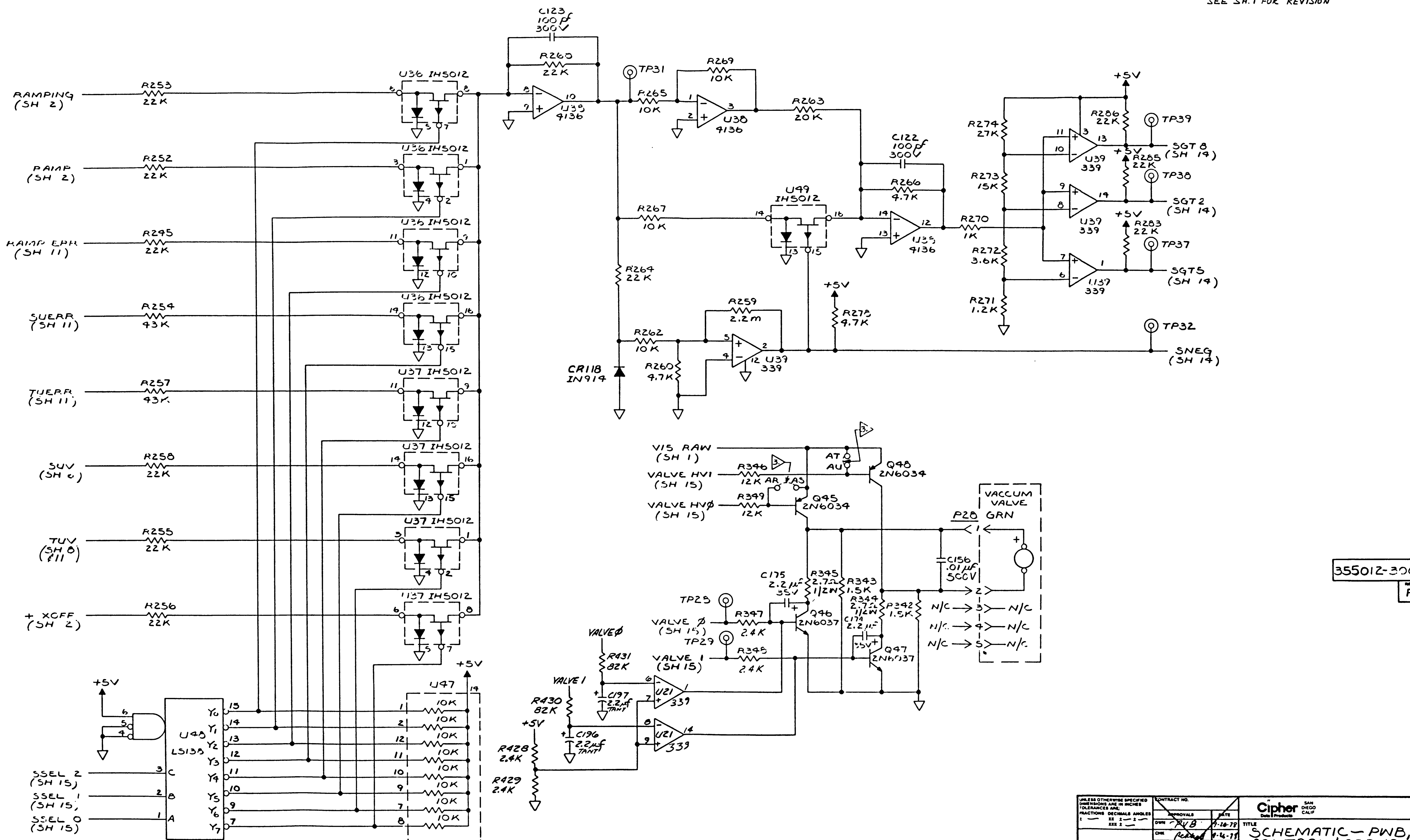
Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC — PWB, CONTROL / SERVO

SIZE D | CODE IDENT NO. 32274 | DRAWING NO. 355012-300 | REV N

SCALE — | 900X | SHEET 11 OF 15

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH. 1 FOR REVISION				



DRAWING NO. 355012 - 300
SHEET 12 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES	CONTRACT NO.
APPROVALS	DATE
DWN PVB	7-26-79
CHK	9-4-79

Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC — PWB, CONTROL / SERVO

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	355012-300	F
SCALE —	900X	SHEET 12 OF 15	

DO NOT SCALE DRAWING

SEE SH. 1 FOR REVISION

U56 Z-80-CPU
M1 MREQ IOREQ RD WR HALT WAIT INT NMI RES BUSRQ BUSAK CLK +5V GND
A0–A15, D0–D7
(SH 19) RD, (SH 19) WR
R407 10K INT
R360 10K NMI
R362 10K BUSRQ
C158 22 µF 6.3 V
Φ

U45 2708 1145
U52 2708
A0–A9, D0–D7, CS
Vdd +12V, Vcc +5V, Vbb -5V, Vss

U93 LS138
MREQ
A15 A14 A13
Y0 ROM, Y1 RAM, Y2 OUTS (SH 14), Y3 INS (SH 14)

U94 LS138
MREQ RD
A11 A10
Y0, Y1
ROM

U72 Z-80-CTC
D0–D7, A7 CE, A0 CS0, A1 CS1 RES, M1, IOREQ, RD, IEI, IEO, INT
R359 10K INT
CLK/TRG0 Φ (N/C)
ZC/TO0 (SH 15)
CLK/TRG1 (N/C)
ZC/TO1 (SH 3)
CLK/TRG2 (N/C)
ZC/TO2 (N/C)
CLK/TRG3 (N/C)
RES
Φ
+5V

U85 2111A
A0–A7, WR, RD/WR, CS1 RAM, CS2 A8, OD RD, D0–D3

U84 2111A
A0–A7, WR, RD/WR, CS1 RAM, CS2 A8, OD RD, D4–D7

U83 7404
U88 7474
U89 7404
C157 1500 pf 100 V
C187 47 pf 300 V
R351 600 Ω
R352 600 Ω
Y1 3.840 MHz
R353 330 Ω
TP36
U87 7474
Sd Cd D C Q

P101
S V 16 A J B
CR100 IN5817
C135 22 µF 6.3 V
R355 220 Ω
U43-16 (SH 15)
P30 RED
DRIVE SELECT SWITCH
CH0 OCK OCL OCM OCJ
ISEL (SH 15)
R356 330 Ω

355012-300 REV P

DRAWING NO. 355012-300
SHEET 13 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE FRACTIONS DECIMALS ANGLES ± — .XX ± — .XXX ± —	CONTRACT NO.		
	APPROVALS	DATE	Cipher Data Products SAN DIEGO CALIF
	DWN PWB	9-20-78	TITLE SCHEMATIC — PWB, CONTROL/SERVO
	CHK [illegible]	9-26-78	
	MFG ENG [illegible]	9-27-78	SIZE D · CODE IDENT NO. 32274 · DRAWING NO. 355012-300 · REV P
	QC		
DO NOT SCALE DRAWING	COG ENG		SCALE — · 900X · SHEET 13 OF 15
	PROD REL		

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE

SEE SH. 1 FOR REVISION

DENSITY SELECT SW1 BF BE BH BG

SEL (SH 15) 6
ONL (SH 15) 5
SNEG (SH 12) 3
OVW (SH 15) 10
REW 11
SGT.5 (SH 12) 13
U44 LS253A
7 → D_0 (SH 13)
9 → D_1 (SH 13)

SRC (SH 15) 6
PHASE Ø (SH 10) 5
BK BJ
OVWL (SH 15) 3
DDS (SH 15) 11
PHASE 1 (SH 10) 12
BR BP
WENL (SH 15) 13
U55 LS253A
7 → D_4 (SH 13)
9 → D_5 (SH 13)

A_1 (SH 13)
A_0 (SH 13)

WEN (SH 15) 6
OVWLL (SH 15) 5
BT BS
SGTZ (SH 12) 3
SFC (SH 15) 10
LOWV (SH 1) 11
BV BU
SGT 0 (SH 12) 13
U62 LS253A
7 → D_2 (SH 13)
9 → D_3 (SH 13)

OPTC (SH 15) 6
SEOT (SH 10) 5
BY BW
DDSL (SH 15) 3
VAC (SH 9) 10
SBOT (SH 10) 11
CA BZ
OPTCL (SH 15) 13
U71 LS253A
7 → D_6 (SH 13)
9 → D_7 (SH 13)

RDI
(SH 13) $\overline{INS}$ 12
(SH 13) $\overline{RD}$ 13
U70 LS32 11
A_5 (SH 13) 5
U70 LS32 6

+5V
U61 LS174
$D_Ø$ 11, D_1 6, D_2 4, D_3 14, D_4 13, D_5 3, $C_Ø$ 7
CLK C1 1
(SH 13)
(SH 1) $\overline{RES}$
CPSCØ (SH 15) 15
CPSC1 (SH 15) 7
5 (SH 15)
16 $\overline{REWUP}$ (SH 2,
15 $\overline{REWDN}$ (SH 2)
S12 (SH 11) 12
S13 (SH 11) 2
14 U77
10K 10K 5 6

U70 LS174
$D_Ø$ 14, D_1 3, D_2 4, D_3 11, D_4 13, D_5 6, C_2 7
CLK C1 1
(SH 13)
(SH 1) $\overline{RES}$
15 ENABLE 4 (SH 3)
2 ENABLE 2 (SH 5)
5 ENABLE 3 (SH 7)
10 11 U88 7404
12 REV CLAMP (SH 2) 7
9 U89 LS06
V15 (SH 1)
R436 2K.
+5V
R438 4.7K
Q61 2N3702
P29 BRN
SW 1 R437 10K
LP1 (SH 15)
U61 LS14
U82 7408
RWC (SH 15)

+5V
U92 LS74
10 S_J
12 D
9 Q
11 C
13 C_J
D_0 (SH 13)
C_7
U92 7430 13 12 11
P101 M ONLS
ONL (SH 15)
11

$\overline{RES}$ (SH 1) 1
U82 7408 2 3
(SH 15) SLTONL 2
(SH 15) OFC 1
U83 LS00 3

U83 LS00 4 5 6

U92 LS74
4 S_J
2 D
5 Q
11 C
13 C_J
D_1 (SH 13)
C_7
SLT1
REW
U92 7430 4 5 6
P101 N RWDG
12
3 C
6 Q
$\overline{REW}$ (SH 15)
1 C_J
$\overline{RES}$ (SH 1)

+5V
U91 LS138
6
(SH 13) $\overline{OUTS}$ 5
(SH 13) $\overline{WR}$ 4
A_6 (SH 13) 3 C
A_5 (SH 13) 2 B
A_4 (SH 13) 1 A
$Y_Ø$ 15 $C_Ø$
Y_1 14 C_1 (SH 15)
Y_2 13 C_2
Y_3 12 C_3
Y_4 11 C_4 (SH 15)
Y_5 10 C_5 (SH 15)
Y_6 9 C_6 (SH 15)
Y_7 7 C_7

P3 RED

(SH 1) $\overline{RES}$ → 3 → SYSRES
C_3 → 4 → $\overline{WEN}$
$D_Ø$ → 6 → BDATA
(SH 13) A_2 → 5 → A_2
A_1 → 8 → A_1
$A_Ø$ → 7 → A_0
RDI 10 U70
(SH 13) A_7 9
LS32 8 → 9 → $\overline{SWEN}$
+5V → 2 → +5V
1 ← GND

CONTROL SWITCH ASSY

355012-300 REV S

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES 2 — .XX ± — .XXX ±	CONTRACT NO.	APPROVALS	DATE
		DWN RWB	9-20-78
		CHK Richard	9-24-78
		SPEC ENG	
		QC	
		COG ENG	
DO NOT SCALE DRAWING		MOD REL	

Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC — PWB, CONTROL / SERVO

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	355012-300	S

SCALE — 900X SHEET 14 OF 15

DRAWING NO. 355012-300
SHEET 14 OF

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
	SEE SH. 1 FOR REVISION				

U58 LS174 — D0–D5 ← (SH 13); C4 ← (SH 14); RES (SH 1); +5V; U50 10K ×6; U57 7406 ×6 → S1–S6 → (SH 11)(SH 13)

U68 7406 — U69 LS174 — D0–D5 ← (SH 13); C5 ← (SH 14); RES (SH 1); +5V; U50 10K ×5; U68 7406 ×6; U68 7406 → S7–S11; VALVE HV0 (SH 12); VALVE HV1 (SH 12); U88 7404; U89 7406

U51 LS174 — D0–D5 ← (SH 13); C6 ← (SH 14); RES (SH 1); SSEL 0; SSEL 1; SSEL 2; VALVE 0; VALVE 1 → (SH 12); P7 YEL → U52 7408 → 12 READ

U40 74LS174 — C1 (SH 14); D2 ← LP1 (SH 14); D3 ← DENSITY SELECT SW1; D4 ← BL; D5 ← BM; D6 ← BN; D7 ← RES (SH 1); U52 LS08 (SLT1, REW); U91 7435 → R LP 14; U EOT 17; P FPT 13; F DDI 6; P7 YEL 8 HI DENS; U79 7402; U92 7438 → CF OPT; U92 7438 → T RDY 16; REW (SH 14) SLTONL; U52 LS08

C135 (SH 13) — PI01 — ISEL (SH 13), IOFC, IRWC, IOVW, IWEN, ISFC, ISRC, IDDS, OPTC CG ← U43 220Ω; U54 74LS14 → SEL, OFC, RWC, OVW, WEN; U61 74LS14 → SFC, SRC, DDS, OPTC → (SH 14)

U60 LS132 — SFC (SH 14), SLTONL (SH 14), SRC (SH 14); R355 750Ω; R357 750Ω; C144 .0047µF 50V; C143 .0047µF 50V; SF, SR

U53 LS175 — OVW, WEN, DDS, OPTC ← (SH 19); OVWL (SH 14), WENL (SH 14), DDSL (SH 14), OPTCL (SH 19); RES (SH 1)

U57 LS74 — OVWLL (SH 14); U52 LS08 (SEL (SH 14), ONL (SH 14)) → SLT 1 P7 YEL 10, SLTONL (SH 14)

U80 LS153 — 1C0 ← P7 YEL WAT RES 2.; U77 7402; 1C1 ← (SH 14) CPSCI; 1C2 ← (SH 14) CPSCØ; 1C3 ← SF; 2C0 ← SBOT (SH 10); U70 74LS32 (SR); 2C1 ← (SH 14) CPSCI; 2C2 ← (SH 14) CPSCØ; 2C3 ← B; A ← 14; U87 7406 → R1FWD (SH 2); U87 7406 → R1REV (SH 2); U82 7408 → P7 YEL → 11 RUN

U78 LS74 ×2 — ZC/TO Ø (SH 13); SCHOP (SH 10); U83 LS00 → CSCHOP (SH 9)

P7 → 1, 7, 3, 4, 5

355012-300 REV P

DRAWING NO. 355012-300 SHEET 15 OF

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS DECIMALS ANGLES .XX ± .XXX ± — DO NOT SCALE DRAWING

CONTRACT NO. — APPROVALS DATE — DWN PVB 9-20-78 — CHK 9-6-78 — MFG ENG 9-11-78 — QC — CODE ENG — PROD REL

Cipher Data Products SAN DIEGO CALIF

TITLE SCHEMATIC — PWR. CONTROL / SERVO

SIZE D — CODE IDENT NO. 32274 — DRAWING NO. 355012-300 REV P — SCALE — 900X — SHEET 15 OF 15

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754012-101	1	PWB-CONTROL/SERVO	DIBBLE ELECTRONICS TYPE ML			
2							
3							
4	154013-901	6	IDCTR ASSY,SERVO FILTER	CIPHER DATA PROD	L1-6		
5	154014-001	1	IDCTR ASSY,P.S. FILTER	CIPHER DATA PROD	L?		
6	154014-002	2	IDCTR ASSY,P.S. FILTER	CIPHER DATA PROD	L7,8		
7	154014-201	2	XFMR ASSY,P.S. FILTER	CIPHER DATA PROD	T2,3		
8	154014-202	1	XFMR ASSY,P.S. FILTER	CIPHER DATA PROD	T1		
9	154014-301	1	XFMR ASSY-SWITCHING RGLTR	CIPHER DATA PROD	T4		
10	799015-501	3	TRANSFORMER-900X SERVO	CIPHER DATA PROD	A1-3		
11							
12	205026	54	TEST POINT .058 DIA PIN	AMP INC. 60802-2	TP1-54		
13							
14							
15	155033-810	1	SOFTWARE ASSY-920X	CIPHER DATA PROD	U45		
16	155033-811	1	SOFTWARE ASSY-920X	CIPHER DATA PROD	U56		
17	731006-800	1	LABEL-ASSY	CIPHER DATA PROD			
18	731501-300	2	RETAINER-P/C CONNECTOR	CIPHER DATA PROD			
19	760003-301	1	STRUT-CONT/SERVO,FMTR	CIPHER DATA PROD			
20	210040-074	4	STDOFF-3/16 HGD,3/4,4-40	AMATOM ELECTRONIC HDW 9225A140			
21	754014-401	9	MTG PLATE-COIL	CIPHER DATA PROD			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
22	754014-501	6	MTG PLATE-COIL	CIPHER DATA PROD			
23	754016-501	1	HEATSINK	CIPHER DATA PROD			
24	754016-701	1	INSULATOR-MYLAR HEATSINK	CIPHER DATA PROD			
25							
26	205133-001	2	CONNECTOR-3 PIN MALE	MOLEX,INC. 09-18-5032	P10,12		
27	205133-002	1	CONNECTOR-3 PIN	MOLEX,INC. 09-18-5031	P29		
28	205133-033	2	CONN WAFER 3 PIN,PC	MOLEX,INC. 09-18-5033	P25,26		
29							
30	205133-037	1	CONN WAFER 3 PIN,PC	MOLEX,INC. 09-18-9037	P27		
31	205133-051	1	CONN WAFER-5 PIN,PC	MOLEX,INC. 09-18-5051	P9		
32	205133-059	2	CONN WAFER-5 PIN,PC	MOLEX,INC. 09-18-5059	P4,5		
33	205133-950	1	CONN,WAFER 5 PIN,PC	MOLEX,INC. 09-18-5950	P30		
34	205133-951	1	CONNECTOR-WAFER 5PIN PC	MOLEX,INC. 09-18-5951	P28		
35	205133-069	1	CONN WAFER 6 PIN,PC	MOLEX,INC. 09-18-5069	P14		
36	205133-094	1	CONN WAFER 9 PIN,PC	MOLEX,INC. 09-18-5094	P3		
37	205068	1	CONNECTOR-12 POSN	MOLEX,INC. 03-09-2121	P7		
38	205012	12	TERMINAL,MALE,093 DIA.,PC	MOLEX,INC. 02-09-2134	(SEE-NOTE#306)		
ALT	205012-001		TERMINAL-MALE,.093DIA,PC LOOSE	NOT ON FILE 159-1050P			
39							
40	201105-011	3	CAP,CER .01UF,3000V	SPRAGUE 30GA-S10	C28,57,80		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
41	201140-001	4	CAP-PC,1UF,50V,2%	ELECTRO CUBE,INC. 650B1A105-G	C113-115,118		
42	201105-100	4	CAP-CER DISC,.IUF,100V	MALLORY TA010	C34,35,60,61		
43	201105-101	24	CAP,CER DISC,.1UF,10V,	CENTRALAB UK10-104	C13,29-32,39,54-56, 58,81-84,65,108,136, 138,140,142,180,183, 184,193		
44	201105-103	20	CAP-CER DISC,.1UF,25V	SPRAGUE 563CY5SBA250AH104Z	C4-7,24,25,50,51,76, 77,107,121,137,139, 141,170,177,178,181, 182		
45	201213-120	24	CAP,CER,.0012MF,50V,10%	CENTRALAB CW15C122K	C14-21,40-47,66-73		
46	201105-010	1	CAP,CER,DISC,.01UF,500V	SPRAGUE 5HKS-S10	C156		
47	201121-470	1	CAP DM 47PF 300V 5% *	CORNELL-DUBILIER ELECT. CD15EC470J03	C187		
48	201122-100	8	CAP DM 100PF 300V 5%	SANGAMO D153E101J0	C12,38,64,120,122, 123,134,173		
49	201122-200	1	CAP DM 200PF 300V 5%	SANGAMO D153E201J0	C9		
50	201122-270	1	CAP DM 270PF 300V 5%	SANGAMO D153E271J0	C171		
51	201122-470	1	CAP DM 470PF 300V 5%	SANGAMO D153E471J0	C125		
52	201122-680	1	CAP DM 680PF 300V 5%	SANGAMO D153E681J0	C3		
53	201123-151	2	CAP,DM,1500PF,100V,5%	CORNELL-DUBILIER ELECT. CD7FA152J03	C98,157		
54	201122-150	2	CAP DM 150PF 300V 5%	SANGAMO D153E151J0	C94,95		
55	201148-220	2	CAP PC .22UF 50V 5%	EL PAC C5A224J	C33,59		
56	201148-470	1	CAP PC .47UF 50V 5%	EL PAC C5A474J	C132		
57							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
58	201140-201	6	CAP-POLY CARB,2.0UF,100V	CORNELL-DUBILIER ELECT. MCR1W2	C26,27,52,53,78,79		
59	201122-220	2	CAP DM 220PF 300V 5%	SANGAMO D153E221J0	C126,117		
60	201144-120	2	CAP PC .012UF 50V 20%	IMB BA2-123	C119,168		
61	201148-100	4	CAP PC .1UF 50V 5%	EL PAC C5A104J	C103-106		
62	201148-150	3	CAP PC .15UF 50V 5%	EL PAC C5A154J	C116,131,117		
63	201148-330	6	CAP PC .33UF 50V 5%	EL PAC C5A334J	133,145,146,149,152, 169		
64							
65	201149-022	2	CAP PC .0022UF 50V 5% 50V 5%	EL PAC C5A222J	C101,102		
66	201149-047	6	CAP PC .0047UF 50V 5%	EL PAC C5A472J	C99,100,127,143,144, 186		
67	201149-091	2	CAP-PC,.0091UF,200V,5%	EL PAC C5A912J	C190,191		
68	201149-100	3	CAP PC .01UF 50V 5%	EL PAC C5A103J	C8,97,200		
69	201149-018	1	CAP-PC,.018UF,50V,5%	EL PAC C5A183J	C172		
70	201149-220	4	CAP PC .022UF 50V 5%	EL PAC C5A223J	C1,2,148,153		
71	201149-390	5	CAP PC .039UF 50V 5%	NOT ON FILE C5A393J	C109-112,128		
72	201149-470	7	CAP PC .047UF 50V 5%	EL PAC C5A473J	C10,11,36,37,62,63,76		
73	201149-680	2	CAP PC .068UF 50V 5%	EL PAC C5A683J	C129,130		
74	201149-330	2	CAP PC .033UF 50V 5%	EL PAC C5A333J	C194,195		
75							
76	201159-022	8	CAP MYLAR.0022UF 200V 10%	CORNELL-DUBILIER ELECT. WMF2D22	C22,23,48,49,74,75, 150,151		
77							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
78							
79	201160-220	4	CAP TANT 2.2UF 35V 10%	NATIONAL COMPONENT IND. CS13BF225K	C174,175,196,197		
80							
81	201191-063	3	CAPACITOR-ALUM WITH EPOXY END SEAL,22UFD,6.3V	PANASONIC CO. ECEB0JV220SR	C135,158,185		
82	201161-470	2	CAP TANT 47UF 6V 10%	NATIONAL COMPONENT IND. CS13BB476K	C166,167		
83	201161-220	1	CAP TANT 22UF 15V 10%	NATIONAL COMPONENT IND. CS13BD226K	C154		
84	201191-025	3	CAPACITOR-ALUM WITH EPOXY END SEAL,10UFD,25V	PANASONIC CO. ECEB1EV100SR	C161,162,172		
85							
86	201172-101	1	CAP,ELECT,100UF,150V	CORNELL-DUBILIER ELECT. WBR100-150	C159		
87	201173-050	1	CAP ELECT 500UF 10V A/L	SPRAGUE 39D507G010EJ4	C160		
88	799600-095	2	CAP-ELECT,1000UF,25V (SPEC CONTROL DWG) *	CIPHER DATA PROD ----------	C163,164		
89	201173-200	1	CAPACITOR-ELECT,2000UF,10	ELECTRA/MIDLAND CORP 39C10FJ23	C165		
90	- 93 ARE BLANK.						
94	210112	1	CRYSTAL 3.84MHZ	STANDARD CRYSTAL CORP. 817-A-3.840MHZ	Y1		
95							
96							
97	202011-744	1	DIODE-ZENER,SILICON	MOTOROLA SEMI. 1N4744	CR105		
98	202013-818	50	DIODE-HOT CARRIER RECTIFIER	MOTOROLA SEMI. 1N5818	CR9-24,37-52,65-80, 109,111		
ALT	202013-717		DIODE-HOT CARRIER	MOTOROLA SEMI. 1N5817			
99	- 105 ARE BLANK.						
106	202018	37	DIODE, SWITCHING	TEXAS INSTRUMENTS IN914	CR1-8,29-36,57-64,94-99,101,102,104,106, 108,118		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
107	202019	3	DIODE-ZENER, 6.8V	FAIRCHILD IN957B	CR103,107,110		
108	202034-100	2	DIODE-RECT,FAST RECOVERY	MOTOROLA SEMI. MR821	CR116,117		
109	202035	4	RECTIFIER-POWER	MOTOROLA SEMI. MR851	CR112-115		
110	202005-500	12	RECTIFIER-PWR,HI EFF,6A	UNITRODE CORP. UES1302	CR25-28,53-56,01-04		
111							
112	203003	6	IC-ANLG SW,4 CHAN	INTERSIL,INC. IH5012CPE	U36,37,49,63,67,77		
113	- 115 ARE BLANK.						
116	203007-200	1	IC-OPER.AMPL	NATIONAL SEMICONDUCTORS LM318N	U2		
117	203007-600	1	IC-OPER AMPL/BUFFER	NATIONAL SEMICONDUCTORS LM324N	U27		
118	203007-700	9	IC-VOLTAGE COMPARATOR	NATIONAL SEMICONDUCTORS LM339N	U6,7,13,14,20,21,27, 39,95		
119	- 122 ARE BLANK.						
123	203008-741	1	IC OP AMP	NATIONAL SEMICONDUCTORS LM741CN	U1		
124	203012-136	14	IC-QUAD OPER AMPLIFIERS	TEXAS INSTRUMENTS RC4136	U5,12,19,26,30-33,38, 46,64-66,76		
125	- 129 ARE BLANK.						
130	203023	1	IC-QUAD 2-INP POS-NAND GT	TEXAS INSTRUMENTS SN7400N	U3		
131	203013-210	2	IC VOLTAGE REGULATOR	MOTOROLA SEMI. MC7812CP	VR1,2		
132	203013-300	2	IC-VOLTAGE REGULATOR	MOTOROLA SEMI. MC7912CP	VR3,4		
133	203013-250	1	IC-VOLTAGE REGULATOR	MOTOROLA SEMI. MC79L05CP	VR5		
134	203023-001	1	IC-QUAD 2-INP POS-NND GT	TEXAS INSTRUMENTS SN74LS00N	U03		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
135	203046-001	1	IC-RTRIG MNST MLTV	TEXAS INSTRUMENTS SN74LS123N	U98		
136	203024	4	IC-QUAD 2-INP POS-NOR GT	TEXAS INSTRUMENTS IC-SN7402N	U8,15,22,77		
137	203026	1	IC-HEX INVERTER	TEXAS INSTRUMENTS SN7404N	U83		
138	203026-500	3	IC-HEX INVERTER BFR/DRVR	MOTOROLA SEMI. MC7406P	U57,68,89		
139	203027	5	IC-QUAD 2-INP POS AND GT	TEXAS INSTRUMENTS SN7408N	U10,17,24,82,99		
140	203027-001	1	IC-QUAD 2-INP POS-AND GT	TEXAS INSTRUMENTS SN74LS08N	U52		
141	203029-003	3	IC-TRIP,3-INPUT AND GATE	TEXAS INSTRUMENTS SN74LS11N	U11,18,25		
142	203035-032	1	IC,QUAD 2 INPUT POSORGATE	TEXAS INSTRUMENTS SN74LS32N	U70		
143	203036	2	IC-QUAD 2-INP POS-NND BFR	TEXAS INSTRUMENTS SN7438N	U41,42		
144	203039-001	4	IC-DUAL-D FLIP-FLOP	TEXAS INSTRUMENTS SN74LS74N	U4,59,78,92		
145	203046-132	1	IC-QUAD, 2 INPUT, POS-NAND-TRIG	TEXAS INSTRUMENTS SN74LS132N	U60		
146	203046-148	4	IC,3-8 LINE DECODER	TEXAS INSTRUMENTS SN74LS138N	U48,91,93,94		
147	203046-153	1	IC,4-1 LINE SEL/MLTP	TEXAS INSTRUMENTS SN74LS153N	U80		
148	203051-174	6	IC,HEX D-TYPE FLIP FLOP	TEXAS INSTRUMENTS SN74LS174N	U40,51,58,69,81,90		
149	203051-100	1	IC-QUAD D-TYPE FLIP-FLOP	TEXAS INSTRUMENTS SN74LS175N	U53		
150	203052-253	4	IC,4-1 LINE SEL/MLTP	TEXAS INSTRUMENTS SN74LS253N	U44,55,62,71		
151	203085-001	3	IC-SCHM,TRIG INPUT,HEX IV	TEXAS INSTRUMENTS SN74LS14N	U28,54,61		
152	203123	1	IC-REG PULSE WIDTH MODULA	TEXAS INSTRUMENTS SG3524N	U97		
153							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
154	203565-102	2	IC-MEMORY MOS RAM 256 X 2	SILICON GENERAL Z111A	U84,85		
155	203555-101	1	IC-CONTROL,MOS	ZILOG Z80CTC	U72		
156	203575-101	1	IC-MICRO PROCESSOR,MOS	ZILOG Z-80 CPU	U86		
157	203039	1	IC-DUAL D-TYPE FLIP-FLOP	TEXAS INSTRUMENTS SN7474N	U87		
158							
159	200200-101	1	POT-TRIMMING,1K	BOURNS INC. 3299X-1-102	R367		
160	200204-200	3	POT 20K CERMET	ELECTRA/MIDLAND CORP ET34P203	R242-244		
161	200205-052	5 *	POT-TRIMMING, 50K	BOURNS INC. 3006P-1-503	R188-191,250		
162	200070-470	14	RES-FC,4.70HMS,1/4W, 5%	NOT ON FILE RCR07G4R7JM	R37-40,89-92,142-145, 403,404		
163	200071-100	1	RES FC 10 OHM 1/4W 5%	NOT ON FILE RCR07G100JM	R370		
164	200071-150	2 *	RES-FC,15 OHMS,1/4,5%	NOT ON FILE RCR07G150JM	R210,408		
165	200071-470	3	RES FC 47 OHM 1/4W 5%	NOT ON FILE RCR07G470JM	R194,195,409		
166							
167	200072-100	1	RES FC 100 OHM 1/4W 5%	R-OHM RCR07G101JM	R400		
168	200072-220	6	RES FC 220 OHM 1/4W 5%	NOT ON FILE RCR07G221JM	R8,170-173,355		
169	200013-196	1	RES FF 1.96K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D1961F	R422		
170	200072-330	14	RES FC 330 OHM 1/4W 5%	NOT ON FILE RCR07G331JM	R21,22,26,27,71,72, 78,87,123,124,130, 140,353,356		
171	200072-470	2	RES FC 470 OHM 1/4W 5%	NOT ON FILE RCR07G471JM	R6,7		
172	200072-560	24	RES FC 560 OHM 1/4W 5%	NOT ON FILE RCR07G561JM	R29-36,79-86,131 134, 136-139		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
173	200072-680	2	RES FC 680 OHM 1/4W 5%	NOT ON FILE RCR07G681JM	R351,352		
174	200072-750	2	RES FC 750 OHM 1/4W 5%	NOT ON FILE RCR07G751JM	R357,358		
175	200013-147	1	RES FF 1.47K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D1471F	R423		
176	200072-910	1	RES FC 910 OHM 1/4W 5%	NOT ON FILE RCR07G911JM	R234		
177	200073-910	1	RES FC 9.1K,1/4W 5%	NOT ON FILE RCR07G912JM	R24		
178	200073-220	1	RES FC 2.20K 1/4W 5%	NOT ON FILE RCR07G222JM	R385		
179	200073-680	1	RES FC 6.80K 1/4W 5%	NOT ON FILE RCR07G682JM	R300		
180	200073-100	7	RES FC 1.00K 1/4W 5%	NOT ON FILE RCR07G102JM	R1,270,384,391,402, 406,426		
181	200073-110	3	RES FC 1.10K 1/4W 5%	NOT ON FILE RCR07G112JM	R28,80,111		
182	200073-120	1	RES FC 1.20K 1/4W 5%	NOT ON FILE RCR07G122JM	R271		
183	200073-150	7	RES FC 1.50K 1/4W 5%	NOT ON FILE RCR07G152JM	R196-199,342,343,377		
184	200073-180	1	RES FC 1.80K 1/4W 5%	NOT ON FILE RCR07G182JM	R211		
185	200073-200	7	RES FC 2K 1/4W 5%	NOT ON FILE RCR07G202JM	R2,292,328,334,397, 427,436		
186	200073-240	5	RES FC 2.40K 1/4W 5%	NOT ON FILE RCR07G242JM	R338,347,348,428,429		
187	200073-300	2	RES FC 3.00K 1/4W 5%	NOT ON FILE RCR07G302JM	R3,4		
188	200073-270	1	RES FC 2.70K 1/4W 5%	NOT ON FILE RCR07G272JM	R377		
189	200073-360	1	RES FC 3.60K 1/4W 5%	NOT ON FILE RCR07G362JM	R272		
190	200073-430	6	RES FC 4.30K 1/4W 5%	NOT ON FILE RCR07G432JM	R291,293,327,329,332, 335		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
191	200073-470	21	RES FC 4.70K 1/4W 5%	NOT ON FILE RCR07G472JM	R9,18,20,25,73-75, 125-127,178,192,193, 260,266,278,309,378, 398,433,438		
192	200073-510	2	RES FC 5.10K 1/4W 5%	NOT ON FILE RCR07G512JM	R301,301		
193	200073-750	6	RES FC 7.50K 1/4W 5%	NOT ON FILE RCR07G752JM	R17,19,69,70,121,122		
194	200074-110	1	RES FC 11.00K 1/4W 5%	NOT ON FILE RCR07G113JM	R77		
195	200074-100	28	RES FC 10.00K 1/4W 5%	NOT ON FILE RCR07G103JM	R11,16,101,233,262, 265,267,269,289,298, 300,303,330,331,302, 369,360,362,365,366, 369,374-376,372,107, 425,437		
196	200074-120	5	RES FC 12.00K 1/4W 5%	NOT ON FILE RCR07G123JM	R129,232,346,349,359		
197	200074-150	13	RES FC 15.00K 1/4W 5%	NOT ON FILE RCR07G153JM	R176,200,201,206,207, 273,275,280,295,413-415,432		
198	200074-390	1	RES FC 39.00K 1/4W 5%	NOT ON FILE RCR07G393JM	R431		
199	200074-200	13	RES FC 20.00K 1/4W 5%	NOT ON FILE RCR07G203JM	R67,68,119,120,202, 204,208,209,212,213, 246,247,263		
200	200074-220	12	RES FC 22.00K 1/4W 5%	NOT ON FILE RCR07G223JM	R245,252,253,255,256, 258,264,268,283,285, 286,364		
201	200074-270	2	RES FC 27.00K 1/4W 5%	NOT ON FILE RCR07G273JM	R274,284		
202	200074-330	6	RES FC 33.00K 1/4W 5%	NOT ON FILE RCR07G333JM	R288,309,311,319,322, 393		
203							
204	200074-430	2	RES FC 43.00K 1/4W 5%	NOT ON FILE RCR07G433JM	R254,257		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
205	200074-470	4	RES FC 47.00K 1/4W 5%	NOT ON FILE RCR07G473JM	R5,10,231,279		
206	200074-820	2	RES FC 82.00K 1/4W 5%	NOT ON FILE RCR07G823JM	R430,431		
207	200074-680	3	RES FC 68.00K 1/4W 5%	NOT ON FILE RCR07G683JM	R58,110,314		
208	200074-750	8	RES FC 75.00K 1/4W 5%	NOT ON FILE RCR07G753JM	R57,109,310,317,320, 321,340,390		
209	200074-360	1	RES FC 36.00K 1/4W 5%	NOT ON FILE RCR07G363JM	R294		
210	200075-100	5	RES FC 100.00K 1/4W 5%	NOT ON FILE RCR07G104JM	R177,313,318,363,372		
211	200075-390	1	RES FC 390.00K 1/4W 5%	NOT ON FILE RCR07G394JM	R277		
212	200075-150	1	RES FC 150.00K 1/4W 5%	NOT ON FILE RCR07G154JM	R312		
213	200075-200	1	RES FC 200.00K 1/4W 5%	NOT ON FILE RCR07G204JM	R373		
214	200075-220	7	RES FC 220.00K 1/4W 5%	NOT ON FILE RCR07G224JM	R235,296,297,299,305, 315,316		
215	200074-510	1	RES FC 51.00K 1/4W 5%	NOT ON FILE RCR07G513JM	R287		
216	200075-270	2	RES FC 270.00K 1/4W 5%	NOT ON FILE RCR07G274JM	R411,412		
217	200075-470	5	RES FC 470.00K 1/4W 5%	NOT ON FILE RCR07G474JM	R281,282,323,324,341		
218	200075-750	2	RES FC 750.00K 1/4W 5%	NOT ON FILE RCR07G754JM	R56,108		
219	200076-220	3	RES FC 2.20MEG 1/4W 5%	NOT ON FILE RCR07G225JM	R203,205,259		
220	200075-330	1	RES FC 330.00K 1/4W 5%	NOT ON FILE RCR07G334JM	R251		
221	200076-470	5	RES FC 4.70MEG 1/4W 5%	NOT ON FILE RCR07G475JM	R23,76,128,182,183		
222	200077-200	2	RES-FC,20M,1/4W,5%	NOT ON FILE RCR07G206JM	R308,325		
223							

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
224	200013-301	1	RES FF 3.01K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D3011F	R387		
225	200013-681	1	RES-FF,6.81K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D6811F	R371		
226	200013-806	1	RES-FF,8.06K,1/8W,5%	ANY ACCEPTABLE SOURCE RN55D8061F	R368		
227	200014-909	1	RES-FF,90.9K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D9092F	R306		
228	200013-221	2	RES FF 2.21K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D2211F	R240,241		
229	200013-249	3	RES-FF,2.49K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D2491F	R237,238,239		
230	200013-499	1	RES FF 4.99K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D4991F	R337		
231	200014-100	21	RES FF 10K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D1002F	R14,15,61-64,113-116, 179,180,184,185,219, 220-222,290,336,388		
232	200014-127	1	RESISTOR,FF,12.7K,1/8W1%	ANY ACCEPTABLE SOURCE RN55D1272F	R248		
233	200014-150	1	RES FF 15K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D1502F	R218		
234	200014-200	2	RES FF 20K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D2002F	R217,229		
235	200014-301	5	RES FF 30.1K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D3012F	R186,187,228,420,421		
236	200014-309	1	RES-FF,30.9K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D3092F	R230		
237	200014-536	6	RES-FF,53.6K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D5362F	R12,13,59,60,111,112		
238							
239	200014-332	4	RES-FF,33.2K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D3322F	R174,175,223,236		
240	200014-715	1	RES-FF,71.5K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D7152F	R215		
241	200014-806	1	RES-FF,80.6K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D8062F	R216,224,225,227		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
242	200015-100	4	RES-FF,100K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D1003F	R65,66,117,118		
243	200015-121	1	RES FF 121K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D1213F	R226		
244	200015-174	1	RES-FF,174K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D1743F	R214		
245	200015-301	1	RES-FF,301K,1/8W,1%	ANY ACCEPTABLE SOURCE RN55D3013F	R306		
246	200082-390	2	RES-FC,390 OHM,1/2W,5%	NOT ON FILE RCR20G391JM	R382,383		
247	200080-270	2	RES-FC,2.7 OHMS,1/2W, 5%	NOT ON FILE RCR20G2R7JM	R344,345		
248	200080-330	24	RES-FC,3.30HMS,1/2W,5%	NOT ON FILE RCR20G3R3JM	R41-43,45,46,49,50, 52,93-95,97,98,101, 102,104,146-148,150, 151,154,155,157		
249	200081-100	12	RES-FC,10 OHMS,1/2W,5%	NOT ON FILE RCR20G100JM	R44,47,48,51,96,99, 100,103,149,152,153, 156		
250	200082-560	2	RES FC 560 OHM 1/2W 5%	NOT ON FILE RCR20G561JM	R381,401		
251	200084-100	1	RES FC 10.00K 1/2W 5%	NOT ON FILE RCR20G103JM	R389		
252	200128-100	7	RES-WW,.100HM,3.75W,5%	DALE ELEC. INC. CW-2B .1-9K	R54,55,106,107,159, 160,405		
253	200122-750	1	RES-WW,750 OHMS,3.75W,5%	DALE ELEC. INC. CW-2B .1-9K	R379		
254	205249	2	RESISTOR NETWORK-10K, 14 PIN *	BECKMAN INSTRUMENTS,INC. 899-1-R10K	U47,50		
255	205255-500	1	RESISTOR NETWORK-220/330	BECKMAN INSTRUMENTS,INC. 898-5-R220/330	U43		
256	205253	3	RESISTOR NETWORK-560 OHM	BECKMAN INSTRUMENTS,INC. 899-1-R560	U9,16,23		
257	211011-016	1	SOCKET,16 PIN LOW PROFILE	AUGAT 216-AG39D	XU43		
ALT	211007		SOCKET-DIP,16 PIN,SOLDER *	CIRCUIT ASSY CORP CA-16S-10SD			

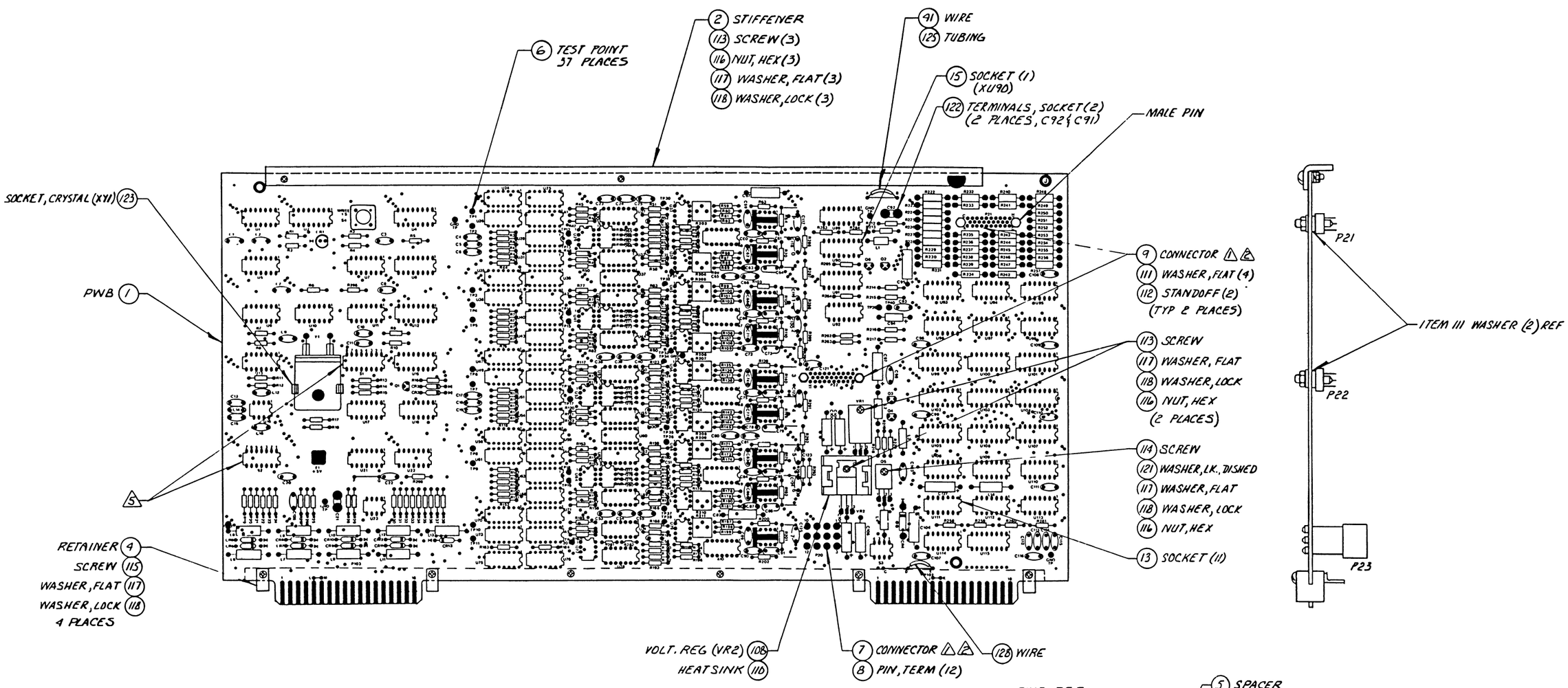
ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
258	211011-018	2	SOCKET,18 PIN LOW PROFILE	AUGAT 218-AG39D	XU84,85		
ALT	211009-180		SOCKET-DIP,18 PIN	CIRCUIT ASSY CORP CA-18S-10SD			
259	211011-024	2	SOCKET,24 PIN LOW PROFILE	AUGAT 224-AG39D	XU45,56		
ALT	211010-500		SOCKET-DIP,24 PIN	CIRCUIT ASSY CORP CA-24S-10SD			
260	211011-028	1	SOCKET,28 PIN LOW PROFILE	AUGAT 228-AG39D	XU72		
ALT	211010-280		SOCKET-DIP,28 PIN	CIRCUIT ASSY CORP CA-28S-10SD			
261	211011-040	1	SOCKET,40 PIN LOW PROFILE	AUGAT 240-AG39D	XU86		
ALT	211010-401		SOCKET-DIP,40 PIN	CIRCUIT ASSY CORP CA-40S-10SD			
262	200015-150	2	RES FF 150K 1/8W 1%	ANY ACCEPTABLE SOURCE RN55D1503F	R307,435		
263	204027-014	24	TRANS-CORE DRVRS,NPN	TEXAS INSTRUMENTS 2N4014	Q1-8,13-20,25-32		
264							
265	204007-500	1	TRANSISTOR-NPN	MOTOROLA SEMI. 2N2222	Q58		
266	204012	2	TRANSISTOR,PNP SILICON	TEXAS INSTRUMENTS 2N3702	Q50,61		
267	204013	6	TRANSISTOR, NPN SILICON	TEXAS INSTRUMENTS 2N3704	Q37,38,41,49,59,60		
268	204016-913	2	TRANSISTOR,NPN SILICON	NATIONAL SEMICONDUCTORS 2N4013	Q54,55		
269	204027-034	4	TRANSISTOR P-N-P SILICON	MOTOROLA SEMI. 2N6034	Q45,48,52,53		
270	204027-037	3	TRANSISTOR N-P-N SILICON	MOTOROLA SEMI. 2N6037	Q46,47,51		
271	204028-500	12	TRANSISTOR-NPN,SILICON	MOTOROLA SEMI. 2N6338	Q9-12,21-24,33-36		
272	204070-002	2	TRANSISTOR-NPN SWITCHING	MOTOROLA SEMI. MJ10002	Q56,57		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
273	799603-100	4	TRANSISTOR-NPN,SILICON, SELECTED	CIPHER DATA PROD ----------	Q39,40,42,43		
274	209990-075	AR	VIBRA-TITE	VC 3			
275	211015-001	1	SWITCH-DIP,4POS,SEALED	AMP INC. 3-435668-4	S1		
276	211000-325	4	SOCKET-TERMINAL	AUGAT LSG-2DG8-1		04-15-81	L*314
277	213271-407	1	SCREW-PAN HD,PHIL, 4-40 X 7/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
278	213271-410	6	SCREW-PAN HD PHIL, 4-40 X 5/8,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
279	213271-606	32	SCREW-PAN HEAD PHIL, 6-32 X 3/8,CAD BLK,OR ZIN	ANY ACCEPTABLE SOURCE			
280							
281	213271-614	3	SCREW-PAN HD PHIL, 6-32 X 7/8,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
282	213274-132	3	SCREW-PAN HD PHIL CAD OR ZINC 10-32X2	ANY ACCEPTABLE SOURCE			
283	207101-081	3	NUT, HEX, RADIO PAT. #10 10-32	NUT #10, CAD.			
284	213703-109	3	WASHER-FLAT,S/S #10	ASM CO. 204-.060-SS-12			
285	207200-023	4	WASHER,FLAT	#2 FIBER			
286	207403-011	6	WASHER,SPLIT LOCK #4	ANY ACCEPTABLE SOURCE WASHER #4 CAD.			
287	207406-081	3	NUT,HEX,RADIO PAT. #4 4-40	ANY ACCEPTABLE SOURCE NUT #4 CAD.			
288	207408-021	7	WASHER,FLAT,SMALL OD #4	ANY ACCEPTABLE SOURCE			
289	207602-011	35	WASHER,SPLIT LOCK #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			
290	207604-081	35	NUT-HEX RADIO PATTERN 6-32	ANY ACCEPTABLE SOURCE NUT #6 CAD.			
291	207608-021	35	WASHER,FLAT,SMALL OD #6	ANY ACCEPTABLE SOURCE WASHER #6 CAD.			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
292	210613	14	INSULATOR,MYLAR-T03	THERMALLOY CO 43-03-2			
293	210613-050	5	INSULATOR-MYLAR	THERMALLOY CO 43-77-2			
294	213700-609	33	WASHER-FLAT,NYLON,SM PAT 5610-46-62	SEASTROM 5610-46-62			
295							
296	210260-003	1	WASHER-LOCK,DISHED TYPE, # 4	SHAKEPROOF 4706-06-01			
297							
298	213703-609	3	WASHER-FLAT,S/S #6	ASM CO. 95-.060-SS-12			
299	208500-298	.5	WIRE BUS TND COPPER 22AWG	ALPHA WIRE CORP, 298			
300	209100-552	.5	TUBING TFL 22 GA	ALPHA WIRE CORP. TFT-200/22-NAT			
301	213274-128	1	SCREW-PAN HD PHIL 10-32 X 1-3/4	ANY ACCEPTABLE SOURCE			
302	208430-907	12	WIRE-SOL 30AWG KYNAR 7"	SONIC WIRE SALES KN-30-130-6-7"			
303							
304							
305	355012-300	REF	SCHEM-PWB,CONTROL/SERVO	CIPHER DATA PROD			
306	* * DO NOT MIX TERMINALS 205012 AND 205012-001 IN SAME CONNECTOR						
307	**********						
308	- 313 ARE BLANK.						
314	205339-200	4	SOCKET-SNAP-SIP	EMC/ELECTRIC MOLDING 14101-01-445	L*276	04-14-81	

154040-009 REV AE

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
AE	REDRAW & INCORP ECO 9731	LS	4-7 81	JH	4-10 81



6. DO NOT INTERMIX TERMINALS, ITEM # 8 (205012) AND ALT PART (205012-001) IN ONE CONNECTOR.

5. ORIENT SWICH NUMBERS WITH SILKSCREEN NUMBERS ON PWB (REF S1, S2 & S3)

4. FOR SCHEMATIC SEE 354040-300;

3. ASSY SHOWN IS FULLY LOADED PWB FOR SPECIFIC CONFIGURATIONS SEE APPROPRIATE PARTS LIST DASH NO. PARTS NOT NEEDED WILL BE OMITTED DURING FAB. OF ASSY.

2. INSTALL CONNECTORS ON FARSIED OF BOARD. DISCARD NUT AND WASHER FURNISHED WITH CONNECTOR. ASSEMBLE WITH WASHER (ITEM 111) AND STANDOFF (ITEM 112) AS SHOWN.

1. MARK EACH CONNECTOR WITH A COLORED PAINT DOT AS FOLLOWS P20- GREEN , P21- RED, P22 - YELLOW.

NOTES:

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
DECIMALS
XX ± 2 ~
XXX ± 2 ~
ANGLES ± 2 ~

DO NOT SCALE DRAWING

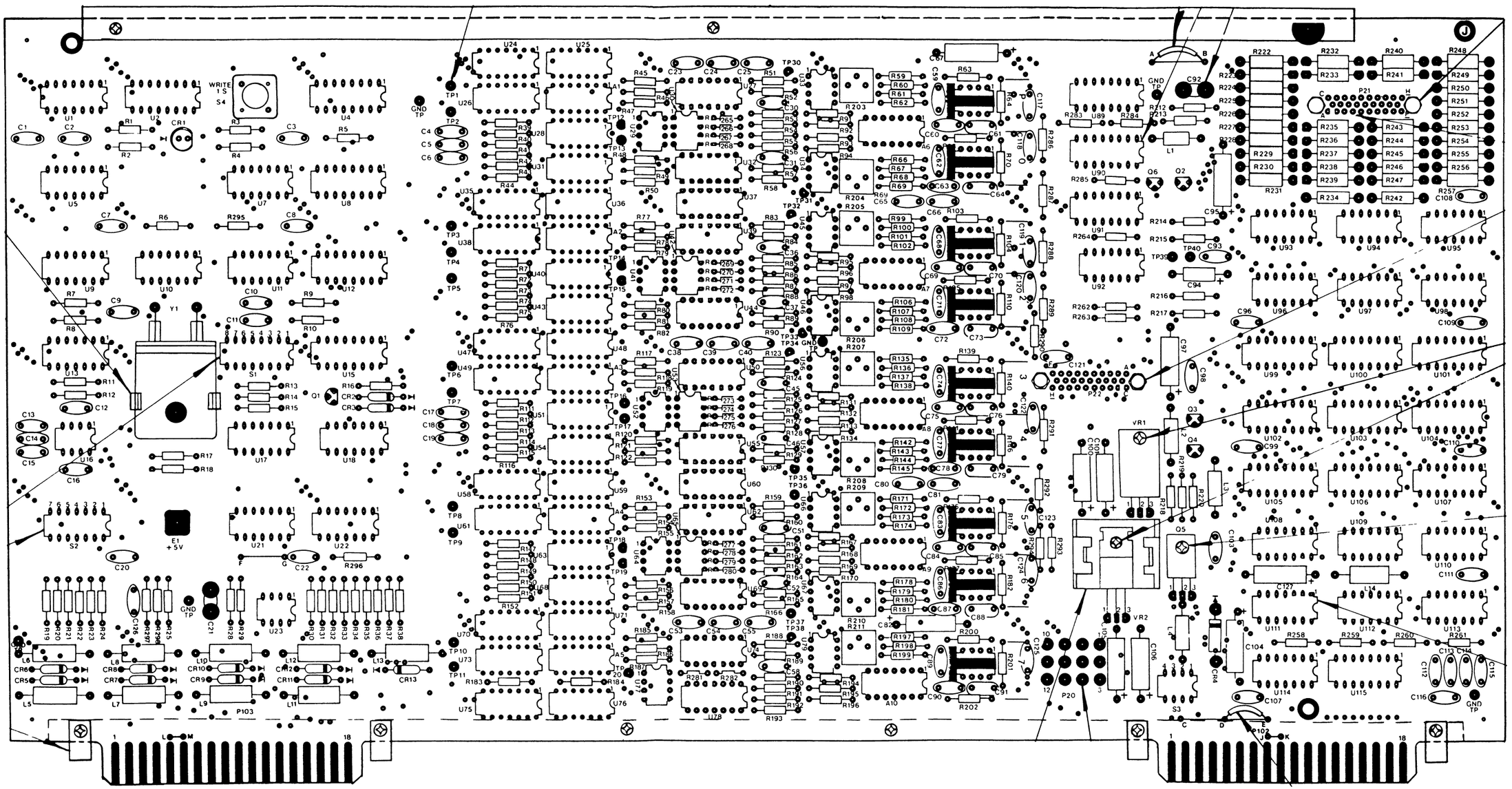
APPROVALS		DATE
DWN	S. SCHNEIDER	8-24-78
CHK	K. BERLING	9-15-78
MECH ENG	B BARTON	9-21-78
ELEC ENG	M DG	9-27-78
MFG ENG	G. SPECHT	9-27-78
QC	M. FRACKER	9-28-78
DOC CONT	J WILLIAMS	9-28-78

Cipher Data Products SAN DIEGO CALIF

TITLE PWB ASSY - DATA, DUAL 9TK RAW (IVO SPEED KIT)

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	154040-009	AE

SCALE 1/1 SHEET 1 OF 1


WRITE PROTECT S4
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354040-300 REV V

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE
A	ENG. REL	LVS	8-17-77		
B	ECO 4206	LVS	8-2-78		
C	ECO 4301	LVS	10-27-78		
D	ECO 4385		11-21-78		
E	ECO 4496		2-21-79		
F	ECO 4499		2-21-79		
G	ECO 4622		5-30-79		
H	ECO 5192	SGS	9-16-79		
J	ECO 5252	VN	9-27-79		
K	ECO 5371	VN	11-8-79		
L	ECO 5415	VN	11-19-79		
M	INCORP ECO 6725	RA	4-4-80		
N	INCORP ECO 6806	RL	4-29-80		
P	INCORP ECO 6938	SGS	5-22-80		
R	INCORP ECO 7492	KMW	5-21-80		
S	INCORP ECO 7634	CW	6-5-80		
T	INCORP ECO 8511	LJ	11-20-80		
U	INCORP ECO 8872	RA	3-6-81		
V	INCORP ECO 9738	LJ	3-23-81		

COMPONENT VALUE TABLE (5)

PWB ASSY	R14	R15
154040-XXX	150K	430K
158010-001	330K	150K

(1) INSTALL JUMPER FOR 154040-009 ONLY.
(10) R296 IS USED ON 158010-001 ONLY.
(5) FOR COMPONENT VALUE SEE TABLE
4. SHEET AND SIGNAL REFERENCE CODE.
(X/S) INDICATES SIGNAL SOURCE SHEET CO.
(X/S) INDICATES SHEET NO. SIGNAL IS GOING TO.
(X/S) INDICATES SHEET NO. SIGNAL IS COMING FROM.
"X" TO LEFT OF BUBBLE INDICATES FIRST SHT. THAT SIGNAL APPEARS ON.
"X" TO RIGHT OF BUBBLE INDICATES LAST SHT. THAT SIGNAL APPEARS ON.
(3) COMPONENTS WITH REF. DES. STARTING WITH "A" ARE MOUNTED ON HEADERS
(2) ALL RESISTORS ARE 1/4W, 5%
ALL 3pf CAPS ARE INTRINSIC, TO PWB.

NOTES: UNLESS OTHERWISE SPECIFIED

REV LTR	V	U	U	U	V
SH NO.S	1	2	3	4	5

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: DECIMALS XX ± .02, XXX ± .010, ANGLES ±2. DO NOT SCALE DRAWING

APPROVALS	DATE
DWN L.W. SKYERNAIL	8-3-78
CHK	
MECH ENG	8-21-78
ELEC ENG	8/22/78
MFG ENG	8-22-78
QC	8-22-78
DOC CONT	8-22-78

Cipher Data Products SAN DIEGO CALIF

TITLE: SCHEMATIC-DATA, DUAL MODE

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	354040-300	V.

SCALE —— SHEET 1 OF 5

354040-300 REV U

CH P

CH Ø

CH 1

OFST

R265 1.5M 1/8W

R266 6.8M 1/8W

R267 6.8M 1/8W

R268 1.5M 1/8W

R269 1.5M 1/8W

R270 6.8M 1/8W

+5V

-12V

R297 220Ω

R298 330Ω

CR5 IN914

CR6 IN914

CR7 IN914

L5 2.7μH

L6 2.7μH

L7 2.7μH

P103

1 RDP

A GND

3 RDØ

C GND

4 RD1

D GND

BITINCH P

CLRØ

XINCHI P

TH+

PESEL

BITINCHØ

XINCHIØ

NRZ

TH-

BITINCH 1

XINCH11

YR

C126 .1μf

APPROVALS DATE

DWN CHK WECH ENG ELEC ENG MFG ENG QC

Cipher Data Products San Diego, CA

TITLE SCHEMATIC-DATA, DUAL MODE

SIZE D | CODE IDENT NO. 32274 | DRAWING NO. 354040-300 | REV U

SCALE — | SHEET 2 OF —

354040-300 REV U

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE

CH 2 — CH 3 — CH 4

R272 1.5M 1/8W · R273 1.5M 1/8W · R274 6.8M 1/8W · R275 6.8M 1/8W · R276 1.5M 1/8W

U37 LS86 · U60 LS86 · U54 LS00 · U43 LS00 · U40 LS05 · U36 LS14 · U47 LS11 · U48 LS14 · U35 7433 · U58 7433 · U38 LS74 · U49 LS74

TP3 · TP6 · TP7 · TP15 · TP16 · TP17 · TP26 · TP27 · TP33 · TP34 · TP35

CR8 IN914 · CR9 IN914 · CR10 IN914

L8 2.7μH · L9 2.7μH · L10 2.7μH

P103 B RD2 · P103 J GND · P103 9 RD3 · P103 K GND · P103 14 RD4 · P103 R GND · P103 5 · P103 6 · W2

BITINCH 2 · CLRØ · XINCH 12 · TH+ · PESEL · BITINCH 3 · XINCH 13 · NRZ · TH- · VR · BITINCH 4 · XINCH 14

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE DECIMALS XX ± XXX ± ANGLES	APPROVALS	DATE	Cipher Data Products SAN DIEGO CALIF		
DO NOT SCALE DRAWING	DWN		TITLE SCHEMATIC-DATA. DUAL MODE		
	CHK		SIZE D	CODE IDENT NO. 32274	DRAWING NO. 354040-300 REV U
	MECH ENG		SCALE —		SHEET 3 OF
	ELEC ENG				
	QA				
	QCE				

354040-300 REV U

REVISION					
LTR	DESCRIPTION	DWN	DATE	APVD	DATE

CH 5 V R P22 OFST

CH 6 K J P22 OFST

CH 7 F B P22 OFST

R277 1.5M 1/8W
R280 1.5M 1/8W
R282 1.5M 1/8W
R278 6.8M 1/8W -12V
R279 6.8M 1/8W -12V
R281 6.8M 1/8W -12V

R161 2.7K R162 2.7K C51 68pF
R164 2.7K R163 2.7K C52 68pF
R189 2.7K R196 2.7K C58 68pF

R209 CW 10K +12V R211 1K C84 .01 R167 1M
R210 CW 10K +12V R169 1K C87 .01 R170 1M
R211 CW 10K +12V R171 1K C90 .01 R202 1M

R172 10K R175 47A C85 20pF R176 1.5K U86 709 R292 2.2K C123 27pF 3pF
R178 10K R177 47A C88 20pF R182 1.5K U87 709 R294 2.2K C124 27pF 3pF
R197 10K R200 47A C91 20pF R204 1.5K U88 709 R293 2.2K C125 27pF 3pF

OFST

R174 15K R173 15K C83 .01 R168 1K U66 TL082 R159 1K
R179 15K R180 15K C86 .01 R181 1M U67 TL082 R166 1K
R199 15K R198 15K C89 .01 R195 1M U79 TL082 R188 1K

TP36 TP37 TP38

U65 LM311 R160 2.2K R155 4.7K
U67 LM311 R165 2.2K R158 4.7K
U69 LM311 R190 2.2K R193 4.7K
U62 319 R154 4.7K
U64 319 R157 4.7K
U66 319 R191 4.7K

U60 LS86 R156 680Ω R150 15K -12V
U68 LS00
U76 LS86 R187 680Ω R192 15K -12V
U78 LS00

U63 LS05 R151 22K
U63 LS05 R152 22K
U63 LS05 R198 22K
U63 LS05 R149 22K
U63 LS05 R183 75Ω R186 22K
U63 LS05 R184 75Ω R185 22K

U59 LS14
U71 LS14

U70 LS11
U61 LS74
U75 LS74

U58 7433
U73 7433

TP9 TP18 TP19 TP8 TP20 TP11

CR11 IN914 L11 2.7μH P103 15 RD5 5 GND
CR12 IN914 L12 2.7μH P103 17 RD6 U GND
CR13 IN914 L13 2.7μH P103 18 RD7 V GND

BITINCH 5
CLR Ø
XINCH 15
TH+
PESEL
BITINCH 6
XINCH 16
NRZ
TH-
VR
BITINCH 7
XINCH 17

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: DECIMALS XX ± XXX ± ANGLES ±	APPROVALS	DATE	Cipher SAN DIEGO CALIF
DO NOT SCALE DRAWING	DWN CHK MECH ENG ELEC ENG MFG QA		TITLE SCHEMATIC-DATA, DUAL MODE
			SIZE D · CODE IDENT NO. 32274 · DRAWING NO. 354040-300 · REV U · SCALE — · SHEET 4 OF

354040-300 REV V

"Use or disclosure of information contained herein is subject to the restriction on the title page of this document."

REVISION				
LTR	DESCRIPTION	DWN	DATE	APVD

X INCH1(P) R34 10K; (0) R35 41K; (1) R37 33K; (2) R36 41K; (3) R38 41K; (4) R31 41K; (5) R30 33K; (6) R32 33K; (7) R33 41K

U23 LM2903 · R28 1K · R29 5.1K · +5V · C21 · U21 LS14 · S2 · R23 4.7K · C3 1000pf · R5 10K · U18 LS74 · NRZ · PE · R22 4.7K · U2 LS123 · RUN · P20 11 · R296 1K · E · F · U21 LS14 · CLR Ø · SELECT P20 10 · U22 ∞ · SLT · R24 4.7K · U1 LS08 · TP10 · HIDEN P20 8 · WSTRB · NRZ P10 10 · GND L P10 · R19 10K · U1 LS08 · U17 7405 · S2

BITINCH · U4 LS133 · U13 LS132 · U8 LS174 · U12 LS161 · U15 LS161 · CARRY · LD · ET · CLK · R10 10K · R9 10K · S1 · U10 7404 · U5 LS27 · R24 10K · PESEL · PE

U8 LS174 · U1 LS08 · U5 LS27 · U10 04 · U18 LS74 · TP5 · P20 1 7 3 4 5 · C67,82,25, 104 47uf 6V · .47 uf 6V · .1uf 10V · C1,4,8,9,15,17,29, 22,25,40,53, 96,99,107,108,109, 111,116,110 .1uf 10V · E1 +5V · A B

U2 LS123 · .10uf C2 · R1 220K · CR1 · R2 220 · +5V · R295 1K · S1 · U9 7438 · SELECT · P103 13 P 7SPEED

U9 7438 · P103 2 RD3 · B GND · NRZ

U112 LS14 · U111 220 · U111 330 · R259 680 · C113 220 · U115 LS123 · C115 22pf · R260 4.7K · C114 22pf · R261 4.7K · P102 WDS A GND 1 · WARS C GND 3 · R258 680 · C112 220pf · U114 LS11 · P20 WRT RESET 2 · CYCLE P · SLT · W TEST · U108 LS86 · P102 RTN2 F GND 6 · P20 READ 12 · TH- · TH+ · +15V/+12V 9 · -15V/-12V 6

S2 · R25 510K · R21 510K · R20 510K · C12 1000pf · R12 24K · U16 1458 · -12V · R11 4.7K · R17 10K · C16 1000pf · R18 10K · U16 1458 · R15 · CR3 IN914 · R14 · CR2 IN914 · R16 2.7K · R13 3.3K · Q4 2N3702 SELECTED

C11 1000pf · C10 30pf 300V · R8 680 · R7 680 · Y1 · U11 LS93 · U7 LS93 · S1 S3 S4 · WRITE 1's · R3 10K · S4 · S1 S6 S5 · U10 7404 · R6 390 · C7 150pf · U13 LS132

+12V · R284 6.8K · R285 10K · R283 4.3K · Q6 2N3304 · R219 10K · R220 1.5K · Q4 2N3702 · Q5 2N6034 · C98 .01uf, 500V · C103 .05uf, 20V · R218 4.7K · L4 · S3 · CR4 IN5335 · TP40 · C94 1.0uf, 35V · C93 .10uf, 25V · R215 4.7K · Q2 2N3704 · TP39 · P102 5 · R214 15 · U92 7406 · R216 4.7K · R217 10K · Q3 2N3702 · R299 4.7K · L2 · C97 10uf, 25V · VR2 7812 · VR1 7912 · C105 10uf, 25V · C106 10uf, 25V · C5,14,18, 24,39,54, 66,81 .01uf, 500V · C100 10uf, 25V · C101 10uf 25V · C6,13,19,23, 38,53,65,80 .01 500V · +12V · -12V

P21: a B d / E J M / R U X · h P21 · f P21 · NRZ VCC

APPROVALS	DATE
DWN R McGee	5/7/78
CHK	
MECH ENG	
ELEC ENG	
MFG ENG	
QC	

DO NOT SCALE DRAWING

Cipher Data Products, San Diego, Calif.

TITLE: SCHEMATIC-DATA DUAL MODE

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D	32274	354040-300	V

SCALE — · SHEET 5 OF

BLANK

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
1	754040-101	1	PWB-DATA,DUAL MODE	DIBBLE ELECTRONICS TYPE 1 OR 2			
2	731511-201	1	STIFFENER-LONG READ/WRITE	CIPHER DATA PROD ----------			
3	731510-400	1	BAR STIFFENER	CIPHER DATA PROD ----------			
4	731501-300	4	RETAINER-P/C CONNECTOR	CIPHER DATA PROD ----------			
5	735000-402	2	SPACER	CIPHER DATA PROD ----------			
6	205026	37	TEST POINT .038 DIA PIN	AMP INC. 60802-2			
7	205068	1	CONNECTOR-12 POSN	MOLEX,INC. 03-09-2121	P20		
8	205012	12	TERMINAL,MALE.093 DIA.,PC	MOLEX,INC. 02-09-2134	(SEE-NOTE#136),P20		
ALT	205012-001		TERMINAL-MALE,.093DIA,PC LOOSE	NOT ON FILE 159-1050P			
9	205061	2	CONNECTOR-29 POSN	WINCHESTER ELECTRONICS SRE 29 PD4J	P21,22		
10	211015-003	1	SWITCH-DIP,8POS,SEALED	AMP INC. 2-435668-8	S1		
11	211015-002	1	SWITCH-DIP,7POS,SEALED	AMP INC. 2-435668-7	S2		
12	211015-001	1	SWITCH-DIP,4POS,SEALED	AMP INC. 3-435668-4	S3		
13	211011-014	11	SOCKET,14 PIN LOW PROFILE	AUGAT 214-AG39D	XA1-10,XU11		
ALT	205023-514		SOCKET-DIP, 14 CONTACTS	AUGAT 514-AG10D			
14	731006-800	1	LABEL-ASSY	CIPHER DATA PROD ----------			
15	211011-016	1	SOCKET,16 PIN LOW PROFILE	AUGAT 216-AG39D	XU20		
ALT	205023-516		SOCKET-DIP, 16 CONTACTS	AUGAT 516-AG10D			
16	201191-063	5	CAPACITOR-ALUM WITH EPOXY END SEAL,22UFD,6.3V	PANASONIC CO. ECEB0JV220SR	C67,82,95,104,127	06-15-81	L*140

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
17	201121-680	9	CAP,DM,68PF,300V,5%	SANGAMO D153E680J0	C30,31,36,37,45,46, 51,52,58		
18	201103-101	21	CAP,CER DISC,.1UF,10V,	CENTRALAB UK10-104	C1,2,4,8,9,15,17,20, 22,25,40,55,96,99, 107,108,109,110,111, 116,126	06-15-81	L#141
19	201103-100	4	CAP CER .001UF 1000V GMV	SPRAGUE 5HK-D10	C3,C11,C12,C16		
20	201103-010	35	CAP,CER,DISC,.01UF,500V	SPRAGUE 5HKS-S10	C5,6,13,14,18,19,23,, 24,38,39,53,54,59,60, 62,63,65,66,68,69,71, 72,74,75,77,78,80,81, 83,84,86,87,89,90,98		
21	201122-150	1	CAP DM 150PF 300V 5%	SANGAMO D153E151J0	C7		
22	201121-300	1	CAP,DM,30PF,300V,5%	SANGAMO D153C300J03	C10		
23	201121-200	9	CAP DM 20PF 300V 5%	SANGAMO D153E200J0	61,64,70,73,76,79,85, 88,91		
24	201121-270	9	CAP DM 27PF 300V 5%	SANGAMO D153E270J0	C117,118,119,120,121, 122,123,124,125		
25	201103-103	1	CAP-CER DISC,.1UF,25V	SPRAGUE 563CY5SBA250AH104Z	C93		
26	201160-100	1	CAP TANT 1UF 35V 10%	NATIONAL COMPONENT IND. CS13BF105K	C94		
27	201191-023	5	CAPACITOR-ALUM WITH EPOXY END SEAL,10UFD,25V	PANASONIC CO. ECEB1EV100SR	C97,100,101,105,106		
28	201104-501	1	CAP-CER DISC,.05UF,20V,5%	CENTRALAB UK20-503	C103		
29	201122-220	2	CAP DM 220PF 300V 5%	SANGAMO D153E221J0	C112,113		
30	201121-220	2	CAP DM 22PF 300V 5%	SANGAMO D153E220J0	C114,115		
31	200074-330	3	RES FC 33.00K 1/4W 5%	NOT ON FILE RCR07G333JM	R30,32,37		
32	799603-100	1	TRANSISTOR-NPN,SILICON, SELECTED	CIPHER DATA PROD ----------	Q1		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
33	202006-100	1	DIODE-LIGHT EMITTING RED	GENERAL INSTRUMENT OPTO MV5053	CR1		
34	202018	11	DIODE, SWITCHING	TEXAS INSTRUMENTS IN914	CR2,3,5-13	06-15-81	L#142
35	202032-390	1	DIODE-ZENER,3.9V,20%	MOTOROLA SEMI. IN5335	CR4		
36	204013	2	TRANSISTOR, NPN SILICON	TEXAS INSTRUMENTS 2N3704	Q2,6		
37	204012	2	TRANSISTOR,PNP SILICON	TEXAS INSTRUMENTS 2N3702	Q3,Q4		
38	204027-034	1	TRANSISTOR P-N-P SILICON	MOTOROLA SEMI. 2N6034	Q5		
39	200073-430	1	RES FC 4.30K 1/4W 5%	NOT ON FILE RCR07G432JM	R203		
40	210915	12	FERRITE BEAD	FERRONICS,INC. 21-170J	L1,2,3,4		
41	208500-298	.7	WIRE BUS TND COPPER 22AWG	ALPHA WIRE CORP. 298	L1,2,3,4,A-G		
42	200073-680	1	RES FC 6.80K 1/4W 5%	NOT ON FILE RCR07G682JM	R204		
43	200073-270	19	RES FC 2.70K 1/4W 5%	NOT ON FILE RCR07G272JM	R16,53-56,85-88,125-128,161-164,189,196		
44	200204-005	9	POT-10K CERMET	BOURNS INC. 3386P-1-103	R203-211		
45	200073-330	1	RES FC 3.30K 1/4W 5%	NOT ON FILE RCR07G332JM	R13		
46	200082-390	9	RES-FC,390 OHM,1/2W,5%	NOT ON FILE RCR20G391JM	R224,228,236,241,243,247,248,252,256		
47	200082-470	27	RES FC 470 OHM 1/2W 5%	NOT ON FILE RCR20G471JM	R223,225,227,229,231,233,235,237,239,240,242,246,249,251,253,255,257,222,226,230,238,245,254,250,232,234		
48	200073-220	1	RES FC 220.00K 1/4W 5%	NOT ON FILE RCR07G224JM	R1		
49	200072-220	2	RES FC 220 OHM 1/4W 5%	NOT ON FILE RCR07G221JM	R2,297	06-15-81	L#143

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 / DESCRIPTION 2	MFG-NAME / MFG-PART#	REF-DES	ST-DATE	END-DATE
50	200074-100	22	RES FC 10.00K 1/4W 5%	NOT ON FILE RCR07G103JM	R3,4,5,9,10,17,18,19, 34,60,66,100,106,136, 142,172,178,197,217,, 219,262,285		
51	200072-390	1	RES FC 390 OHM 1/4W 5%	NOT ON FILE RCR07G391JM	R6		
52	200072-680	13	RES FC 680 OHM 1/4W 5%	NOT ON FILE RCR07G681JM	R7,8,45,48,77,80,117, 120,153,156,187,258,, 259		
53	200073-470	25	RES FC 4.70K 1/4W 5%	NOT ON FILE RCR07G472JM	R11,46,47,49,50,70, 79,81,82,118,119,121, 122,154,155,157,158, 191,193,215,216,218, 260,261,299		
54	200074-240	1	RES FC 24.00K 1/4W 5%	NOT ON FILE RCR07G243JM	R12		
55	200073-150	10	RES FC 1.50K 1/4W 5%	NOT ON FILE RCR07G152JM	R64,70,104,110,140, 146,176,182,201,220		
56	200073-150	1	RES FC 150.00K 1/4W 5%	NOT ON FILE RCR07G154JM	R14		
57	200073-430	1	RES FC 430.00K 1/4W 5%	NOT ON FILE RCR07G434JM	R15		
58	200073-510	3	RES-FC,510K,1/4W,5%	NOT ON FILE RCR07G514JM	R20,21,23		
59	200074-470	8	RES FC 47.00K 1/4W 5%	NOT ON FILE RCR07G473JM	R22,23,24,31,33,35, 36,38		
60	200072-330	1	RES FC 330 OHM 1/4W 5%	NOT ON FILE RCR07G331JM	R298	06-15-81	
61	200073-510	1	RES FC 5.10K 1/4W 5%	NOT ON FILE RCR07G512JM	R29		
62	200074-150	27	RES FC 15.00K 1/4W 5%	NOT ON FILE RCR07G153JM	R39,42,61,62,67,68, 71,74,101,102,107, 108,111,114,137,138, 143,144,147,150,173, 174,179,180,192,198, 199,		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
63	200074-220	18	RES FC 22.00K 1/4W 5%	NOT ON FILE RCR07G223JM	R40,41,43,44,72,73, 76,75,112,113,115, 116,148,149,151,152, 185,186		
64	200073-100	20	RES FC 1.00K 1/4W 5%	NOT ON FILE RCR07G102JM	R28,51,58,59,83,90, 93,97,99,123,130,133, 135,159,166,169,171, 188,194,295		
65	200073-220	18	RES FC 2.20K 1/4W 5%	NOT ON FILE RCR07G222JM	R52,57,84,89,124,129, 160,165,190,206,207, 288,289,290,291,292, 293,294		
66	200071-470	9	RES FC 47 OHM 1/4W 5%	NOT ON FILE RCR07G470JM	R63,65,103,105,139, 141,175,177,200		
67	200076-100	18	RES FC 1.00MEG 1/4W 5%	NOT ON FILE RCR07G105JM	R69,91,92,94,95,96, 98,109,131,132,134, 145,167,168,170,181, 195,202		
68	200071-750	2	RES FC 75 OHM 1/4W 5%	NOT ON FILE RCR07G750JM	R183,184		
69	200073-200	2	RES FC 2K 1/4W 5%	NOT ON FILE RCR07G202JM	R212,264		
70	200073-300	1	RES FC 3.00K 1/4W 5%	NOT ON FILE RCR07G302JM	R213		
71	200071-150	1	RES-FC,15 OHMS,1/4,5% *	NOT ON FILE RCR07G150JM	R214		
72	200071-100	1	RES FC 10 OHM 1/4W 5%	NOT ON FILE RCR07G100JM	R263		
73	200066-150	9	RES-FC,1.5 MEG,1/8W,5%	ANY ACCEPTABLE SOURCE RCR05G155JM	R265,268,269,272,273, 276,277,280,282		
74	200066-680	9	RES-FC,6.8 MEG,1/8W,5%	ANY ACCEPTABLE SOURCE RCR05G685JM	R266,267,270,271,274, 275,278,279,281		
75	205255	1	RESISTOR NETWORK-220/330	BECKMAN INSTRUMENTS,INC. 899-5-R220/330	U111		
76	203027-001	1	IC-QUAD 2-INP POS-AND GT	TEXAS INSTRUMENTS SN74LS08N	U1		
77	203046-001	2	IC-RTRIG MNST MLTV	TEXAS INSTRUMENTS SN74LS123N	U2,113		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
78	203095-500	1	IC-13INPUT POS NAND GATE	TEXAS INSTRUMENTS SN74LS133N	U4		
79	203029-027	1	IC-TRIPLE THREE INPUT POSITIVE NOR GATE *	TEXAS INSTRUMENTS SN74LS27N	U5		
80	203042-501	2	IC-4-BIT BIN CNTR	TEXAS INSTRUMENTS SN74LS93N	U7,U11		
81	203051-174	1	IC,HEX D-TYPE FLIP FLOP	TEXAS INSTRUMENTS SN74LS174N	U8		
82	203036	1	IC-QUAD 2-INP POS-NND BFR	TEXAS INSTRUMENTS SN7438N	U9		
83	203026	1	IC-HEX INVERTER	TEXAS INSTRUMENTS SN7404N	U10		
84	203048-100	3	IC-SYN,4-BIT COUNTER	NATIONAL SEMICONDUCTORS DM74LS161N	U12,15,71		
85	203046-132	1	IC-QUAD, 2 INPUT, POS-NAND-TRIG	TEXAS INSTRUMENTS SN74LS132N	U13		
86	203010	1	IC-DUAL OPERATIONAL AMPL	SIGNETICS N5558V	U16		
87	203026-003	1	IC-TTL HEX INVERTER POS NAND (OPEN COLLECTOR)	TEXAS INSTRUMENTS SN7405N	U17		
88	203039-001	6	IC-DUAL-D FLIP-FLOP	TEXAS INSTRUMENTS SN74LS74N	U18,26,38,49,61,73		
89	203083-001	8	IC-SCHM,TRIG INPUT,HEX IV	TEXAS INSTRUMENTS SN74LS14N	U21,25,36,48,59,71, 112,113		
90	203023	1	IC-QUAD 2-INP POS-NAND GT	TEXAS INSTRUMENTS SN7400N	U22		
91	203010-001	1	IC-VOLTAGE COMPARATORS	NATIONAL SEMICONDUCTORS LM2903N	U23		
92	203029-003	4	IC-TRIP,3-INPUT AND GATE	TEXAS INSTRUMENTS SN74LS11N	U24,47,70,114		
93	203007-350	9	IC-VOLT COMP/BFR	NATIONAL SEMICONDUCTORS LM319N	U27,32,39,44,50,55, 62,74,69		
94	203026-600	4	IC-TTL HEX,INVERTER POS NAND (OPEN COLLECTOR)	TEXAS INSTRUMENTS SN74LS05N	U28,40,51,63		
95	203007-351	9	IC-VOLTAGE COMPARATOR	NATIONAL SEMICONDUCTORS LM311N	U29,30,41,42,52,53, 64,65,77		
96	203130	9	IC-JFET INPUT OP AMPS	TEXAS INSTRUMENTS TL082P	U33,34,43,46,56,57, 66,67,79		

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
97	203042-001	6	IC-QUAD EXCLUSIVE OR GATE	TEXAS INSTRUMENTS SN74LS86N	U37,60,76,108,109,110		
98	203043-500	9	IC-UP AMP HI PERFORMANCE	TEXAS INSTRUMENTS SN72709P	U80-88		
99	203046-002	1	IC-TTL DUAL VOLTAGE CONTROLLED OSCILLATOR	TEXAS INSTRUMENTS SN74S124N	U89		
ALT	154040-701		HEADER ASSY-VOLTAGE CONTROLLED OSCILLATOR	CIPHER DATA PROD			
100							
101	203026-500	1	IC-HEX INVERTER BFR/DRVR	MOTOROLA SEMI. MC7406P	U92		
102	203030-417	6	IC-HEX BFR/DRIVER	TEXAS INSTRUMENTS SN7417N	U93-98		
103	203042-800	9	IC-DUAL J-K FLIP-FLOP	TEXAS INSTRUMENTS SN74LS112N	U99-107		
104	203032-501	3	IC-TTL QUAD,2INP,POS-NOR BUFFER,,O/C	TEXAS INSTRUMENTS SN7433	U35,50,,73		
105	203023-001	5	IC-QUAD 2-INP POS-NND GT	TEXAS INSTRUMENTS SN74LS00N	U31,54,68,73,43		
106							
107	203013-300	1	IC-VOLTAGE REGULATOR	MOTOROLA SEMI. MC7912CP	VR1		
108	203013-210	1	IC VOLTAGE REGULATOR	MOTOROLA SEMI. MC7812CP	VR2		
109	209991-002	10	INDUCTOR-2.7UH,+-20%	DALE ELECTRONICS,INC. IR-4	L5-14	06-13-81	
110	210145	1	HEAT SINK	IERC PA2-1CB	XVR2		
111	205061-004	8	WASHER FLAT FIBRE	SMITH,HERMAN H. 2191			
112	210030-171	4	STANDOFF 1/8 2-56 HEX BR	AMATOM ELECTRONIC HDW 8100-B-0256			
113	213271-403	5	SCREW-PAN HD PHIL, 4-40 X 5/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
114	213271-407	3	SCREW-PAN HD,PHIL, 4-40 X 7/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			
115	213271-409	4	SCREW-PAN HD PHIL, 4-40 X 9/16,CAD,BLK,ZINC	ANY ACCEPTABLE SOURCE			

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
116	207406-081	6	NUT,HEX,RADIO PAT. #4 4-40	ANY ACCEPTABLE SOURCE NUT #4 CAD.			
117	207408-021	12	WASHER,FLAT,SMALL OD #4	ANY ACCEPTABLE SOURCE			
118	207403-011	12	WASHER,SPLIT LOCK #4	ANY ACCEPTABLE SOURCE WASHER #4 CAD.			
119							
120							
121	210260-003	1	WASHER-LOCK,DISHED TYPE, # 4	SHAKEPROOF 4706-04-01			
122	211000-325	4	SOCKET-TERMINAL	AUGAT LSG-2DGB-1	XC21,XC92		
123	211000-200	1	SOCKET-ASSEMBLY,CRYSTAL	AUGAT 8000-DG1	XY1		
124							
125	209100-552	.15	TUBING TFL 22 GA	ALPHA WIRE CORP. TFT-200/22-NAT	4114*5414		
126							
127	210806-500	1	SWITCH-PUSH BUTTON,NON	ROCO SWITCH RS5035	S4		
128	208500-605	1	WIRE-JUMPER,INSULATED	SQUIRES ELECTRONICS 0.500X0.125PVC22			
129							
130	354040-300	REF	SCHEMATIC-DATA,DUAL MODE	CIPHER DATA PROD ----------			

131 - 134 ARE BLANK.

135 * (NO SPEED KIT FOR 154040-009)
136 * * DO NOT INTERMIX TERMINALS ITEM #0 (205012) & ALT PART (205012-001) IN ONE CONNECTOR
137
138
139 **********

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
140	201191-006	4	CAPACITOR-ALUM WITH EPOXY END SEAL,4.7UFD,6V	PANASONIC CO. ECEADJV1D1SR	C67,82,95,104	L*16	06-14-81
141	201105-101	20	CAP,CER DISC,.1UF,10V,	CENTRALAB UK10-104	C1,2,4,8,9,15,17,20, 22,25,40,55,96,99, 107,108,109,110,111, 116	L*18	06-14-81
142	202018	2	DIODE, SWITCHING	TEXAS INSTRUMENTS IN914	CR2,3	L*34	06-14-81
143	200072-220	1	RES FC 220 OHM 1/4W 5%	NOT ON FILE RCR07G221JM	R2	L*49	06-14-81

PARTS LIST 154040-008 PWB ASSY-DATA DUAL, 9TK,RAW,125IPS REV A 09-27-78 (PRINTED: 07-31-80) PAGE 1
5 LINES

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	154040-009	1	PWB ASSY-DATA DUAL, 9TK,RAW (NO SPEED KIT)	CIPHER DATA PROD			
2	154040-608	1	SPEED KIT-125 IPS	CIPHER DATA PROD			
3							
4	454040-000	REF	DASH NO INDEX/PWB ASSY-DATA DUAL	CIPHER DATA PROD			
5	354040-300	REF	SCHEMATIC-DATA,DUAL MODE	CIPHER DATA PROD			

PARTS LIST 154040-608 SPEED KIT-125 IPS REV B ECO# 4315 09-29-78 (PRINTED: 07-31-80) PAGE 1

5 LINES

ITEM	CIPHER PART #	QTY	DESCRIPTION 1 DESCRIPTION 2	MFG-NAME MFG-PART#	REF-DES	ST-DATE	END-DATE
1	154040-408	5	HEADER ASSY	CIPHER DATA PROD	A1,2,3,4,5		
2	154040-416	5	HEADER ASSY	CIPHER DATA PROD	A6,7,8,9,10		
3	201213-018	1	CAP-CER,1800PF,100V,10%	AVX CERAMICS CK05BX182	C21		
4	201121-561	1	CAP-DM,56PF,500V,5%	SANGAMO CM05FD560J03	C92		
5	210111-512	1	CRYSTAL-QUARTZ,6.400 MHZ	STANDARD CRYSTAL CORP. 815-A-6.400 MHZ	Y1		

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ADDENDUM J

799855-100

ALTERNATE SPEED ADJUSTMENT PROCEDURE (125ips/75ips)

This Addendum presents the electrical adjustments and modifications required to operate the Model 920 Magnetic Tape Transport at 75-ips tape speed. The addendum, together with the Cipher Technical Manual No. 799855-000, presents all additional operational and maintenance information necessitated by the change in operating speed.

ADDENDUM J

ADJUSTMENTS FOR MODEL 920 TRANSPORT FOR 75-IPS TAPE SPEED

J-1. SCOPE

J-2. This addendum presents instructions for adjusting the Model 920 Magnetic Tape Transport for a tape speed of 75 ips.

J-3. INITIAL ADJUSTMENT TO 125-IPS SPEED

J-4. Adjust the capstan motor speed to 125 ips in accordance with paragraphs 5-30 through 5-35 of the basic manual.

J-5. Make the reel servo/capacitive transducer adjustments in accordance with paragraphs 6-6 through 6-15 and paragraph 5-45 of the basic manual.

NOTE

This is a final reel servo adjustment. Do not readjust following 75-ips tape speed adjustment.

J-6. ADJUSTMENT TO 75-IPS SPEED

J-7. Verify the dc offset adjustment in accordance with paragraph 5-31 of the basic manual.

J-8. COARSE SPEED ADJUSTMENT. Make a coarse adjustment of speed in accordance with the following procedure:

a. Monitor tachometer output voltage at TP12, located on capstan servo portion of control/servo board. (See Figure 5-1; basic manual, for location of test points.)

b. With transport in off-line mode (ON LINE indicator not illuminated), depress FWD pushbutton.

c. Adjust forward potentiometer R244 until voltage at TP27 is approximately +1.5 Vdc at a speed of 75 ips.

d. Depress FWD pushbutton to stop tape motion, the depress REV pushbutton.

e. Adjust reverse potentiometer R243 until voltage at TP27 is approximately -1.5 Vdc for speed of 75 ips.

f. Depress REV pushbutton to stop tape motion.